FLIGHT
The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World
Founder and Editor: STANLEY SPOONER
A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport
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DIARY OF FORTHCOMING EVENTS.

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list:

1921
Jan. 10 ... **Meeting of the Bureau of the Federation Aeronautique Internationale in Paris**
Jan. 20 ... **Lecture, "The Cost of Air-Ton-Miles, compared with other Forms of Transport," by Lord Montagu of Beaulieu, before R.Ae.S.**

EDITORIAL COMMENT

IT is a part of the penalty to be paid by all pioneer enterprises that accidents and untoward happenings are magnified out of all proportion to their importance. It was so in the case of the railways, and again in that of the motor-car. Nowadays it is aerial transport which suffers at the hands of the sensation-mongers. The slightest accident that occurs to an aircraft of any description is reported at length, and where, unfortunately, fatal results accrue, as much space is given to it by the "halfpenny" Press as would be devoted to an account of a great battle. We had a case in point the other day, in connection with the fatal crash at Cricklewood. Undoubtedly, it was a bad accident, and nobody can possibly regret it more than those who are associated in any way with aerial transport; but, bad as it was, there was no need to have featured it in the way that was done by the *Daily Mail* in particular. We have always had the greatest admiration for the great encouragement which has been extended to aviation by Lord Northcliffe and his papers, and not least by the *Daily Mail*; but why the latter should have gone out of its way to make a sensation of this one accident is incomprehensible. It gave practically two full columns to reports of the accident, with pictures of the pilot and one of the passengers who was killed, and a sketch map of the scene and a diagram showing how and where the accident happened. The headlines were about the last word in sensationalism. True, in a short leader elsewhere on the subject, the *Mail* pointed out that, until this unfortunate occurrence, only one passenger had been killed on the London-Paris air route since the services began in August, 1919. It is emphasised that these services have been run in all weathers and under all conditions, with hardly any interruptions, while the number of miles flown runs into hundreds of thousands. "It is doubtful," the article concludes, "whether any other form of transport in its early development could have shown such a high percentage of safety."

The Press and the Cricklewood Smash

That being so, we are given to wonder why the *Mail* gave such prominence to an extraordinary happening, and why it should have gone out of its way to do harm to an industry which has surely enough troubles without their being added to by forced publicity of the kind we are referring to. More especially are we impelled to ask this by reason of the fact that the record of a railway accident in the south of France, in which ten people were more or less seriously injured, is dismissed in a five-line paragraph! as "the usual daily railway accident in France." The evening and other papers also inclined to want of sense of proportion, but none so badly as their contemporary. Most also took a sane view of the occurrence. The *Evening Standard* was content to deplore the ill-luck which caused the accident, and to remark that had such an occurrence been associated with train or motor-car it would have been regarded from a different point of view. It predicates that this accident will not affect aviation

detrimentally, because the people of the country thoroughly realise that flying has come to stay. That, we submit, is the proper outlook upon such accidents. We cannot but deplore that such happenings should be avidly seized upon by the sensational Press to be the subject of screaming headlines and lurid descriptive reports which only pander to the more morbid tastes of the multitude and do no good to anybody.

The Cause of the Fatalities

The official inspection of the wrecked machine renders it beyond a doubt that no lives would have been lost in the accident had it not been for the bursting of the petrol tank and the firing of the spirit. Fire has recently been a diminishing factor in aerial fatalities. So much so that we had begun to hope that this cause of disaster had been practically eliminated by new safeguards which have been devised to prevent the catching fire of the petrol when, unfortunately, a crash does occur. Safety tanks and the isolation of pilot's and passengers' cabins from the power plant have gone a long way to counteract the undoubted danger from fire; but this last accident seems to indicate that there still remains something to be done before we are able to say that no matter what may befall the aeroplane itself, the fire danger has been completely eliminated.

Exactly what measures will have to be taken we are not able to say at the moment. These require close investigation and doubtless experiment, so that it would be futile to become dogmatic and to say that this or that must be done. Nevertheless, it is possible to say that developments are in progress which will, we believe, have the ultimate effect of completely removing this most terrible danger of the air. There is no more fearful fate to be contemplated than that of death in the manner in which the victims of the Cricklewood accident lost their lives. To be killed outright in a fall is bad enough, but it is nothing in comparison to being slowly burnt to death in the midst of blazing wreckage. Protection against fire—absolute protection at that—is one of the very first essentials to the success of civil aviation, and we are glad to know that this is thoroughly well realised by designers and operating firms.

The Airco Stoppage

The speculations of a fortnight ago have now become the facts of to-day, and the Airco service between London and Paris, which was the first daily service to start in August, 1919, has definitely closed down. The reasons assigned for this disastrous happening are the falling-off in winter traffic, the difficulties of the present financial situation, and the deferring of the long-promised Government support of civil aviation. The results of this closing down will certainly not help matters. The terminal air port at Waddon will now be simply supporting a number of Government controllers, ground men, and wireless and meteorological experts—at the expense of the British taxpayer—mainly for the supervision of the subsidised French machines which, by the direct assistance they receive from their Government, are still able to carry on. The Handley-Page service, which is left alone in the field as the British representatives of cross-Channel air transport, uses the Waddon aerodrome sometimes, but its real home is at Cricklewood, so that what we have said regarding Waddon stands.

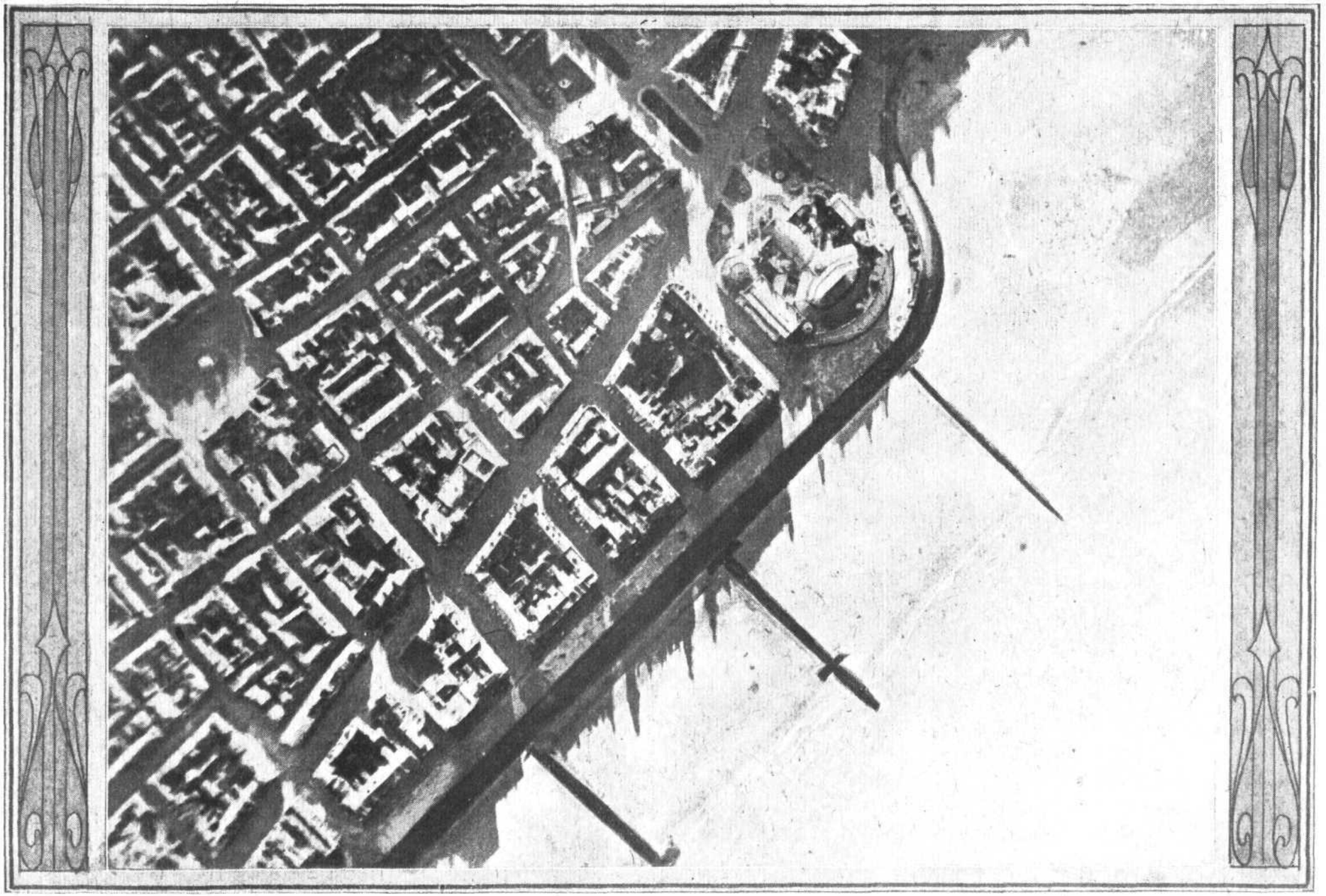
Does the Government really intend to do anything for civil aviation or does it not? We are getting very tired of the vague statements made by one member of the Government and another as to what may possibly be done at some future time. Mr. Churchill, speaking on the Air Estimates recently, said that some kind of support would be given next year. The promise is perhaps better than nothing, but unfortunately the performance may come too late to save the industry from complete collapse and disappearance. A fortnight ago we had two services to Paris in being. Now we have but one. The moral is obvious.

The Future of Air Power

As we have so often insisted, and as all the authorities are agreed, the future of air power is completely wrapped up in the encouragement of civil aviation. In the present state of the world's finances no single Power, not even America or Japan, can afford to maintain an active fighting air service on the scale which will be necessary to command the air. There is only one way in which such aerial supremacy can be obtained, and that is by the organisation of a small, but very highly efficient, nucleus fighting service, backed up by large civilian reserves available for war purposes almost at a moment's notice. This is a fundamental fact which cannot be questioned for a moment. It has been agreed over and over again by all who have studied the question of air power in its relation to national defence.

Accepting this premise, it becomes perfectly clear that the nation which most fully recognises it and applies the principles to action, will secure the unquestioned command of the air in the next great war. We speak of the next great war because we are most absolutely convinced that wars will continue to arise so long as the world is organised as it is. Leagues of Nations and arbitration treaties cannot alter the ultimate principle that the whole basis of order rests upon the application of force. Therefore, war will remain the last resort for the settlement of disputes, and the nation which believes otherwise is doomed to a rude awakening from another which has better interpreted the universal principle.

In this matter of air power it seems clear that other nations have a better appreciation of the needs of the future than we. Or, possibly, it would be more correct to say that they have been quicker to apply the principles which we admit to be correct but are neglecting. France recognises it, and by a well-calculated scheme of encouragement is setting out to obtain the lead in air transport, which means air power. No less than £3,200,000 is to be devoted to the encouragement of aerial industry next year. Big grants are to be made to private enterprises. Subsidies will be given to existing air lines conducting services between London and Paris, Brussels, Toulouse and Monaco, with extensions to Amsterdam, Strasbourg and Warsaw. Large sheds are to be constructed at Marseilles, Algiers, Casablanca and Tunis, so that a service of airships between France and North Africa may be put into regular operation. Regular seaplane services between Antibes, Marseilles, Perpignan and Tunis, Algiers, Oran and



A unique view of Ostend, showing the famous Casino, taken from a Handley Page aeroplane travelling on the London–Brussels air service. Note the reflections of the buildings in the water.

Agadir are to be established. Further, it is proposed to spend a substantial amount of money in making an air port at Constantinople. The mileage flown by commercial aircraft this year is about 93,000 miles. In 1921 it is estimated that it will be a million kilometres (621,000 miles).

Germany is going ahead very fast, in spite of the disabilities imposed by the Peace Treaty. It is startling to hear that the Deutsche Luft Rederei celebrated recently the fact that their machines had covered a million kilometres since beginning operations in February last year. They had carried 3,545 passengers in 6,208 flights, besides 500 tons of cargo, including 33 tons of mail matter. The Air Department is in a state of semi-suspense for the present, but the openly stated objects are to keep track of progress abroad and to prepare a plan of State subvention of the industry until the latter shall have established its position

All this makes unpalatable reading to those of us who looked forward to our retention of the unquestioned lead in the air which this country held at the end of the War. One way and another that lead has been frittered away, and with it are rapidly disappearing all hope of securing the essential measure of supremacy for purposes of Empire defence. We may be very sure that when once France and Germany have established a lead they will strain every nerve and resource to keep it. The gravest indictment which can be brought against our own Government is that a well-thought-out scheme of encouragement would be far from extravagant in cost, and we should unquestionably get our money back in the end. Aerial transport can be made to pay. It seems to pay on the Continent, and if there, why not here? But even if an initial loss had to be faced, what is that against the safety of the Empire? Obviously it ought not to enter into the calculations at all. Yet while all this is being done abroad we here have to be content with half-promises and nebulosities which carry us nowhere, and in the meantime most of our aviation firms, manufacturing and operating, are going out of business. When at last the Government makes up its mind to really do something, the extravagant process of beginning all over again will probably face them.

THE LONDON-CONTINENTAL SERVICES

FLIGHTS BETWEEN DECEMBER 12 AND DECEMBER 18, INCLUSIVE

Route‡	No. of flights*	No. of passengers	No. of flights carrying Mails	No. of flights carrying Goods	No. of journeys completed†	Average flying time	Fastest time made by	Type and No. (in brackets) of Machines Flying
						h. m.		
Croydon-Paris	11	17	2	8	9	2 35	Airco 16 G-EAPM (2h. 10m.)	A.16 (3), A.18 (1), B. (3), G. (1), Sp. (1).
Paris-Croydon	8	4	4	8	1	2 25	—	A.16 (2), A.18 (1), B. (3), G. (1), Sp. (1).
Cricklewood-Paris ...	1	6	1	—	0	—	—	H P. (1).
Paris-Cricklewood ...	1	2	—	1	1	2 49	—	H.P. (1).
Cricklewood-Brussels ...	—	—	—	—	—	—	—	—
Brussels-Cricklewood ...	2	—	2	2	0	—	—	A.4 (1), A.9 (1).
Totals for week ...	23	29	9	19	11			

* Not including "private" flights. † Including certain journeys when stops were made *en route*.
‡ Including certain diverted journeys.

A.4 = Airco 4. A.9 = Airco 9 (etc.). Av. = Avro. B. = Breguet. Br. = Bristol. Bt. = B.A.T. F. = Fokker. Fa. = Farman F.50. G. = Goliath Farman. H.P. = Handley Page. N. = Nieuport. P. = Potez. Sa. = Salmson. Se. = S.E.5. Sp. = Spad. V. = Vickers Vimy. W. = Westland.

The following is a list of firms running services between London and Paris, Brussels, etc., etc. :—Air Post of Banks; Air Transport and Travel; Co. des Grandes Expresses Aériennes; Handley Page Transport, Ltd.; Instone Air Line; Koninklijkie Luchtvaart Maatschappij; Messageries Aériennes; Syndicat National pour l'Étude des Transports Aériens; Co. Transaérienne.

What Germany Says

IN answer to the Note of the Allied Governments despatched on November 16, prohibiting the manufacture and importation of aeronautical material until three months after Article 202 of the Peace Treaty had been carried out, the German Government has addressed the following Note to the Ambassadors' Conference :—

"The German Government is not in a position to impose on German nationals the fresh limitation demanded. The extension of the period prohibiting aircraft construction would be too great a burden for the financial strength of the aeronautical industry to bear, and it would mean that it would have to make up its mind to abandon its undertakings altogether. In this way a great branch of industry of great importance from the point of view of civilisation would be destroyed and the economic strength of Germany weakened still further. The only interest which the Ambassadors' Conference can have in extending the period prohibiting construction is the fear that the resumption of building would, owing to the difficulty of distinguishing between old and new material, make the carrying out of the arrangements for the surrender of war material still harder. As a matter of fact the materials to be delivered have, apart from a small remnant, all been handed over to the Commission of Control, and the German Government is preparing at present for her legal measures to secure the speedy and complete identification of the remaining material.

"The reasons which appear to the Allied Governments to render it desirable that the prohibition period should be extended will thus very shortly disappear. The German Government is quite willing to enter into negotiations as to the manner in which control shall be exercised in the meantime to ensure that in the manufacture of aircraft no material shall be used which ought to be surrendered, as well as with regard to the measures to be taken if this should nevertheless be done, and would willingly show itself obliging to the Allied Governments in the settlement of this question. The German Government begs that the question may be considered again, consideration being given to the above explanations, and proposes that in the event of its point of view not being shared by the Allies, the matter be submitted to an impartial arbitration tribunal."

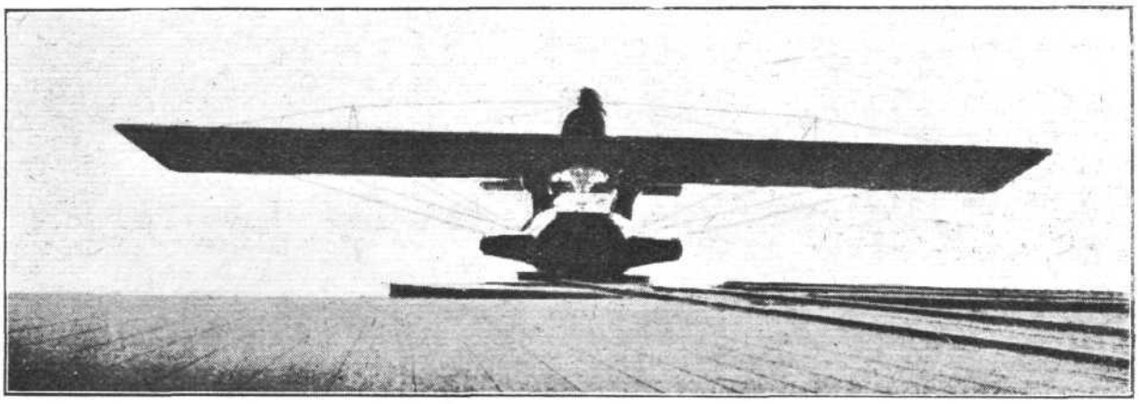
FLIGHT
AIRCRAFT ENGINEER AIRSHIPS

SOME DORNIER "MILESTONES"

(*Concluded from page* 1273)

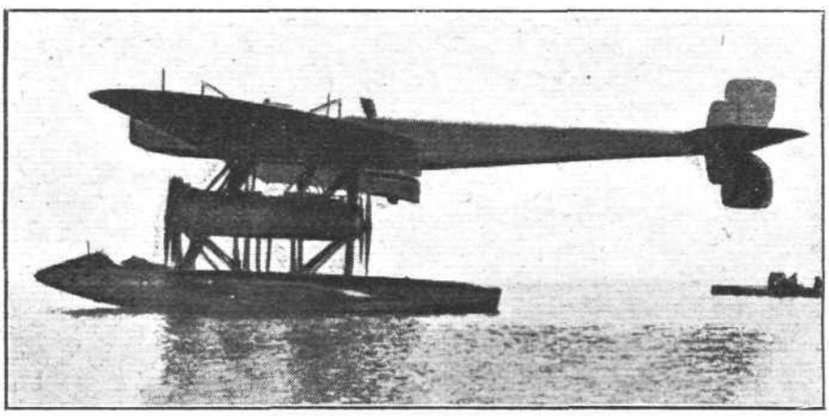
The Do. Rs. IV, 1917-18

THE first result of the experience gained with the Do. C. I was the construction of the next flying boat in the series, the Do. Rs. IV, which had this feature in common with the lines of the Rs. III, even to the *fuselage* above the wing As already mentioned, however, the *fuselage* was braced by the metal covering, which was not the case in the Rs. III. The wing is braced above and below by cables, but it will be



The Do. Rs. IV : Front view, showing top king posts.

land machine that its *fuselage* was braced by the metal covering only. (This machine was described and illustrated in FLIGHT of September 18, 1919.) As the illustrations will show, the Rs. IV is a monoplane flying boat with four engines placed between the boat hull and the monoplane wing. The four engines were 270 h.p. Maybachs, and drove tractor



The Do. Rs. IV : This boat is similar to Rs. III, but has king posts above the wings.

and pusher screws respectively. A feature claimed for this engine arrangement is that it is possible to attend to the engines during flight, while the fact that they are close together results in very small yawing moments when one engine cuts out. In general arrangement the Rs. IV, follows

noticed that the Rs. IV has king posts on top, while the Rs. III had plain top bracing. The span in both cases was the same.

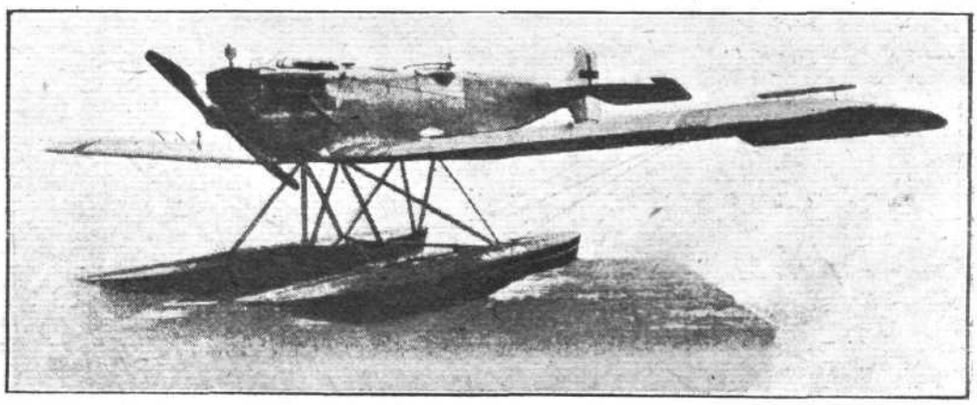
It might be mentioned that at the same time as the building of the Rs. IV, work was progressing at Lindau on the development of metal floats for seaplanes, and such good results were obtained that in the latest Dornier machines metal floats are employed exclusively, with, it is claimed, excellent results. One of the first machines to be fitted with these metal floats was

The Do. Cs. I, 1918

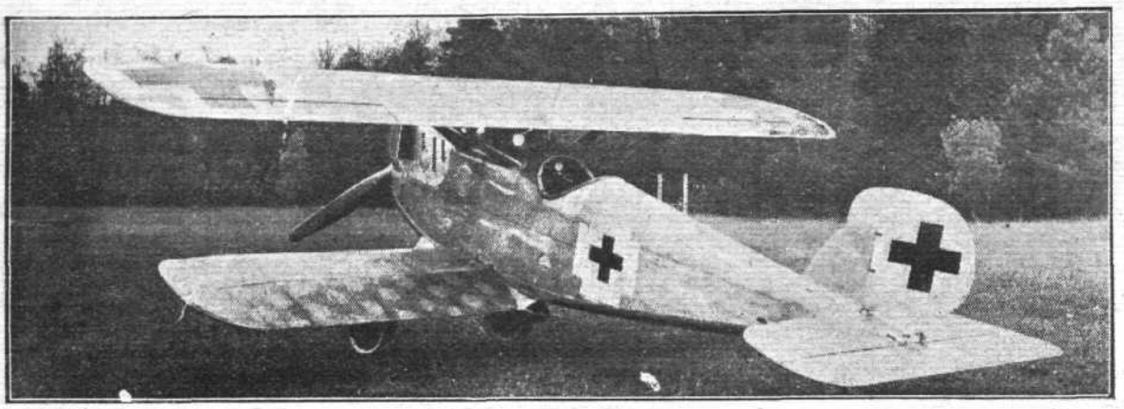
Of this machine little information is available, except that which may be gleaned from an inspection of the accompanying photograph. She was, it will be seen, designed somewhat on the lines of the Hansa-Brandenburg monoplane seaplanes which were such a familiar sight in the North Sea once upon a time. That is to say she was a monoplane with the wings placed in the position occupied by the lower wing of a biplane. The engine was a 195 h.p. Benz. and the machine was a two-seater, with a turntable for the rear gun and with two synchronised machine-guns for the pilot. This machine had the metal covered unbraced *fuselage* and all-metal floats, but from the fact that she does not appear to have been turned out in quantities one presumes that she showed no advantage over existing types, at any rate not sufficient to supplant the Hansa-Brandenburg.

The Do. D.I, 1918

Although being a land machine, and thus having no direct relation to the development of Dornier flying boats, a machine produced early in 1918 is of more than ordinary interest, as being probably the first all-metal machine in the world in



The Do. Cs. I : This machine was a twin float seaplane somewhat similar to the Hansa-Brandenburg.

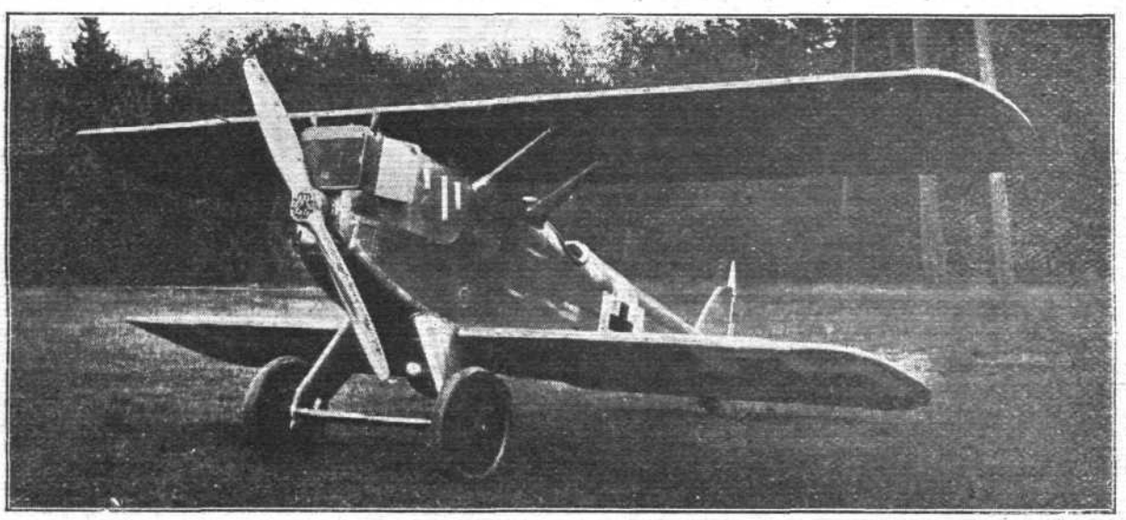


THE DO. D. I : Three-quarter rear view.

which the metal covering not only of the *fuselage* but also of the wings is designed to take part of the stresses. The machine referred to was a small single-seater with a 185 h.p. B.M.W. engine, and was given the series number Do. D. I. As the two photographs will show, it was of extraordinarly clean appearance with its cantilever biplane wings and its metal *cocque fuselage*. The radiator was placed in the nose, and

The Commencement of Commercial Design

With the Armistice in November, 1918, came the prohibition preventing German constructors from carrying on, and consequently progress at Lindau was greatly hampered. However, it appears that it was possible to do a certain amount of designing work, which resulted in the production of the commercial type flying boat.

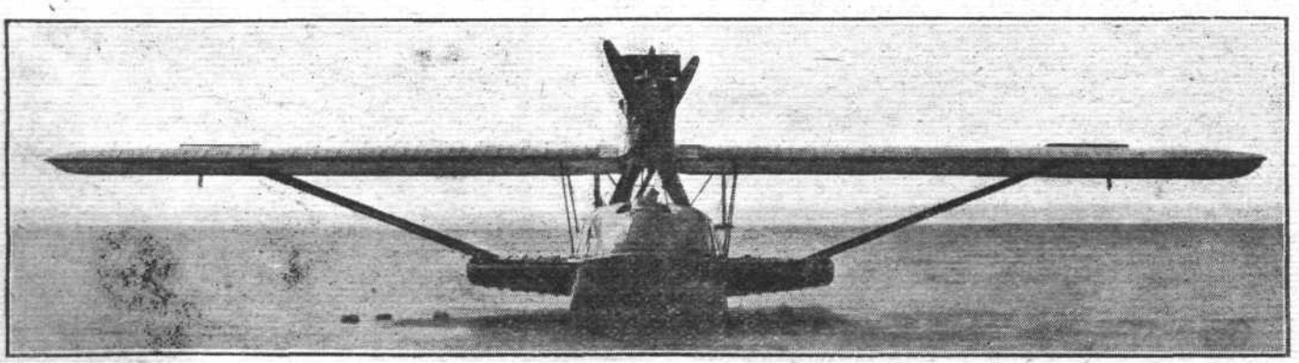


THE DO. D. I: This land machine is entirely without wire or cable bracing, the wings being of the cantilever type and the *fuselage* having metal covering. Note the faired undercarriage members.

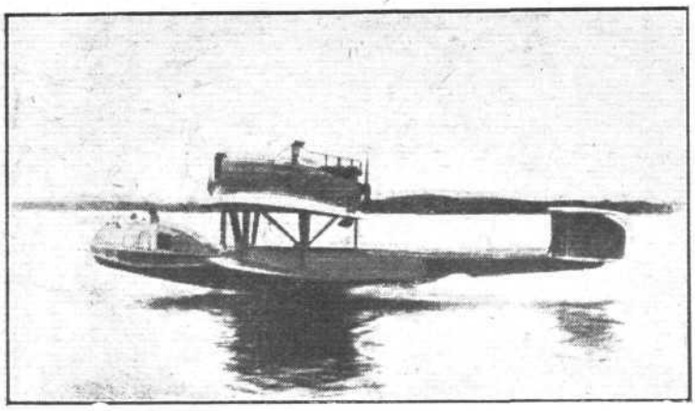
appears to English eyes to be decidedly on the small side. From the accompanying table it will be seen that for its area the D. I was fairly heavy, the weight empty being 7.6 lbs./sq. ft. and the useful load only 400 lbs., bringing the total wing loading up to 9.6 lbs./sq. ft. That the cantilever wings were able to support such a heavy loading appears to indicate that the construction was sound.

The Gs. I, 1919

This machine is a monoplane flying boat built throughout (except the wing covering) of steel and alumin. alloy. It shows the lateral fins or stabilisers employed in earlier types, and has tube lift bracing, but the power plant consists of two engines only, 260 h.p. Maybachs, mounted above the wing, tandem fashion, and driving tractor and pusher air-screws



THE DO. GS. I: This boat, purchased by the Swiss Ad Astra Co., has done a great amount of flying, and has given good results. The simplicity of the bracing and the clean general appearance are features of this machine.



THE DO. GS. I : View of the machine taking off

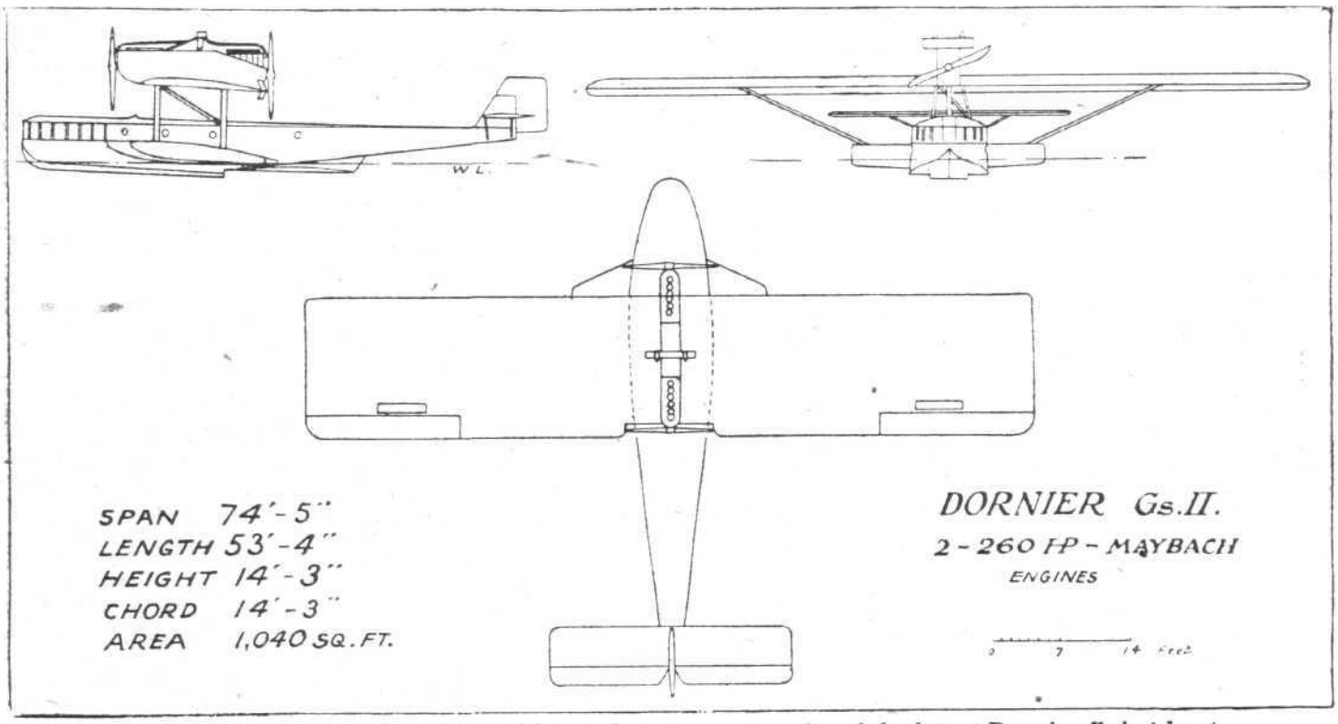
respectively. The front engine has a nose radiator, but the rear one has its radiator mounted above the engine housing, as shown in the illustrations. The cabin, which is quite a small affair, is added in the nose of the boat, a position in which, it will be seen, it was necessary to terminate it in front of the tractor screw. Owing to its small passenger accommodation this machine is scarcely such a pronounced commercial type as is its successor the Do. Gs. II. The machine was sold to the Swiss Ad Astra Co., and did a lot of flying in the autumn and winter of 1919. During the course of nearly two months of this period the machine was never once housed in a shed, and it is claimed that no adjustments or repairs were necessary. By way of illustrating the strength of the construction, the makers relate that once, while on a visit to the German Naval Air Station at Noderney, the machine was left sitting on the beach at low tide, when a gust of wind picked it up, and after lifting it several metres into the air deposited it none too gently on the beach 30 metres away from its original mooring. The hull was not strained in the slightest. It has already been mentioned that the wings of the Do. Gs. I are fabric covered. This is the standard covering, but if desired metal covering can be supplied, in which case the useful load is reduced by about 400 lbs. This is, of course, a rather serious addition to the structural weight. This machine appears to have the same facility for leaving the sea without any spray as had earlier models, as will be seen from one of our photographs. Incidentally, from this photograph, which shows the machine from the side, one would be inclined to think that the hull shape was such as to cause porpoising, but as to whether or not this was the case we have no information.

The Do. Gs. II, 1920

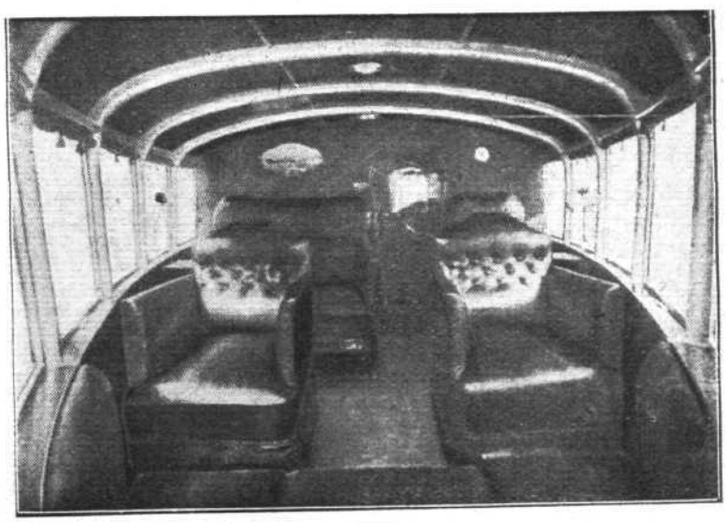
The latest model to be turned out from the Zeppelin Lindau works is the Do. Gs. II, which is a development of the Gs. I. The general arrangement is shown in the accompanying scale drawings, from which it will be seen that the chief alteration is in the cabin arrangement, the roof of the cabin extending aft and passing under the tractor screw of the front engine. This gives considerably more cabin space, seats being provided for seven to nine passengers inside the cabin. The pilot's cockpit is aft of the cabin, and contains two seats, one for the pilot and one for the engineer. Aft of this cockpit is the luggage room and the main petrol tanks. The two engines, as in the previous type, are 260 h.p. Maybachs, and are mounted above the wing. The latter is of similar shape and construction to, although of greater span and area than, that of the Gs. I. Instead of the biplane tail of the Gs. I, the latest type has a monoplane tail.

One of our photographs shows the passengers' cabin, which is entered through a door in the extreme nose. It is very comfortable and roomy, and at a pinch nine passengers can be got in without undue overcrowding.

In looking back on the different types of Dornier flying boats, one is mainly impressed by two factors in the development—the reduction in the number of engines, and the gradual raising of the engine position. The first boat has three engines placed in the hull and driving screws between the wings. The following four boats had four engines each,



THE DO. GS. II : Plan, side and front elevations, to scale, of the latest Dornier flying boat



View inside the cabin of the Do. Gs. II, looking aft.

first placed in the hull, and later mounted between the hull and the monoplane wing. Finally in the latest designs the number of engines has been reduced to two, placed *above* the wing. When it is remembered that Herr Dornier was given a free hand and was not expected to turn out machines which would be of use in the war, it will be realised that he was not hampered by war-time requirements but could devote his attention entirely to aerodynamic and structural considerations. Consequently one should regard his work from a somewhat different point of view, and this is, we think, the reason why more than ordinary interest attaches to the Dornier Zeppelins. Few designers have had such facilities during the last six years, and it is to be expected that the Zeppelin Lindau factory is more favourably placed for making an immediate start with commercial machines than is any other German factory. It therefore seems worth while to keep an eye on the coming products of this firm, and we shall endeavour to keep our readers informed on any new developments which may come along from the shores of Lake Constance.

In the following table are given the main characteristics of the Dornier machines from 1914 to date.

TABLE OF DATA OF ZEPPELIN (DORNIER) MACHINES

Type	Year	Engines	H.P.	No.	Length o.a.	Span	Area	Weight empty	Weight loaded	Load/h.p.	Load/sq.ft.
					ft. ins.	ft. ins.	sq. ft.	lbs.	lbs.	lbs.	lbs.
Do. Rs. I ..	1914–15	Maybach ..	240	3	95 9	143 7	3,540	—	—	—	—
Do. Rs. II ..	1915–16	Maybach ..	240	4	79 0	109 8	2,760	15,600	20,480	21·3	7·42
Do. Rs. III..	1916–17	Maybach ..	260	4	75 0	122 3	2,430	15,850	23,550	22·6	9·7
Do. C. I ..	1917	Mercédès ..	160	1	24 7	39 9	290	1,540	2,310	14·4	7·96
Do. Rs. IV..	1917–18	Maybach ..	270	4	73 7	122 3	2,430	15,400	23,550	21·8	9·70
Do. Cs. I ..	1917–18	Benz ..	195	1	29 5	44 0	323	2,580	3,235	16·6	10·0
Do. D. I ..	1918	B.M.W. ..	180	1	21 1	25 8	200	1,520	1,915	10·7	9·57
Do. Gs. I ..	1919	Maybach ..	260	2	50 6	69 4	850	6,600	9,450	18·2	11·1
Do. Gs. II ..	1920	Maybach ..	260	2	53 4	74 4	1,300	6,800	9,800	18·8	7·54

AIR MINISTRY NOTICES

(136) Pulham (Norfolk): Flying of Kites and Kite Balloons

ARRANGEMENTS have been made for kites and kite balloons to be flown at the aerodrome at Pulham (Norfolk) for the purpose of making meteorological observations.

Pilots flying in the neighbourhood of Pulham should, therefore, keep a careful lookout, as the wire of the kite and the cable of the balloon constitute a danger to aircraft.

In cloudy weather, aircraft should avoid Pulham, except when arrangements have been made beforehand with the C.A.T.O., Pulham, for the kites or kite balloons not to be flown.

(138) Holland: Regulation Governing Flying Height—Customs Facilities at De Mok

1. THE Dutch Government have issued instructions forbidding aircraft to fly over any town or closely-inhabited area in Holland except at such a height that it will always be possible to glide to a point outside such town or area with engines stopped. In no case shall this height be less than 1,000 metres (approximately 3,300 ft.).

2. Notice to Airmen No. 126 of November 17, 1920, is amended as follows:—

DE MOK.—Civil and Naval Seaplane Station.

Customs.—A machine cannot ordinarily be cleared by the Customs authorities at this station, but arrangements may be made for customs examination by obtaining permission from the Commandant prior to arrival. In this case the Commandant will notify the Customs authorities. Normally seaplanes should proceed to Schellingwoude.

(137) Aerodrome List Amendments (374357/20)

NOTICE to Airmen No. 106 (Consolidated List of Aerodromes), of October 1, 1920, is amended as follows:—

LIST B.—*Aerodromes available for civil machines in emergency only.*

The following should be deleted from List B (*b*) (Stations temporarily retained for Service purposes) and added to List B (*c*) (Civil Stations):—

Aerodromes. Name.	Lat.	Long.	Height above sea-level.	Nearest Railway Station.	Nearest Town. Name.	Distance from Aerodrome in miles (by road).	True Bearing from Aerodrome.
Pulham (Airship) ..	52° 24′ 30″ N.	1° 13′ 30″ E.	130 ft.	Pulham St. Mary (G.E.R.) ¾ mile	Harlestone Norwich	3 16	E. N.N.E.

LIST C.—(*b*) *Civil Aerodromes licensed as "suitable for Avro 504 K and similar types of aircraft only."*

The following should be added:—

Northenden	53° 24′ 0″ N.	2° 16′ 0″ W.	120 ft.	Northenden (Cheshire Lines Rly.) ½ mile	Stockport	4½	E.
Knutsford, Tabley Lane	53° 18′ 0″ N.	2° 23 0″ W.	200 ft.	Knutsford (Cheshire Lines Rly.) 1 mile	Knutsford	½	E.

The "Airco" Service Stops

WE comment on page 1286 on the closing-down of the "Airco" London–Paris service, which started in August, 1919, and was brought to a conclusion with the passing of the two "Airco" machines between London and Paris on December 16. It had been hoped that it would have been possible to carry on until the spring, but the efforts failed, with the result stated.

Air Mail to Paris

THE Postmaster-General announces that the latest times at which letters for air mail to Paris can be accepted over the counter at certain post offices in London will, until further notice, be 20 minutes earlier than formerly, and will be as follows:—

General Post Office, 10.40 a.m.: Threadneedle Street branch office, 10.25 a.m.; Lombard Street branch office, 10.25 a.m.; Parliament Street branch office, 10.5 a.m.; Charing Cross branch office, 10.25 a.m.; Western Central district office, 10.45 a.m.; Western district office, 10.25 a.m.; South-Western district office, 10.20 a.m.; South-Eastern district office, 9 a.m. Registered letters must be handed in five minutes earlier in each case.

The latest times of posting in public letter-boxes in London and the latest times of posting in the Provinces remain unchanged.

No Air Mails at Christmas

THE Postmaster-General announces that no air mails will be despatched from London to Paris and Brussels from Saturday, December 25, till Tuesday, December 28, inclusive

Aërial Mails in New Zealand

WITH the New Year, New Zealand will commence its first aerial mail services between Christchurch and Timaru (South Island), and Auckland and Whangarei (North Island) according to information received by the High Commissioner for New Zealand.

FLIGHT

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

MEETING OF JOINT STANDING COMMITTEE OF THE ROYAL AERO CLUB AND THE SOCIETY OF BRITISH AIRCRAFT CONSTRUCTORS

A MEETING of the Joint Standing Committee of the Royal Aero Club and the Society of British Aircraft Constructors was held on Thursday, November 25, 1920, when there were present :—

Royal Aero Club :—
Lieut.-Col. J. T. C. Moore-Brabazon, M.C., M.P., in the Chair.
Brig.-Gen. Sir Capel Holden, K.C.B., F.R.S.

Society of British Aircraft Constructors :—
Capt. P. D. Acland.
Com. James Bird.
Mr. Alan E. L. Chorlton.
Mr. Charles V. Allen (Secretary, Society of British Aircraft Constructors).

Racing Committee of Royal Aero Club :—
Maj.-Gen. Sir Sefton Brancker, K.C.B.
Col. F. Lindsay Lloyd, C.M.G., C.B.E.
Group-Capt. C. R. Samson, C.M.G., D.S.O., R.A.F.
Harold E. Perrin, Secretary.

Programme of Racing, 1921.—A discussion took place as to the Racing Events for 1921, and a suggested programme was drawn up for submission to the Committee of the Club.

International Races.—It was decided that representatives of the Society of British Aircraft Constructors should meet the Racing Committee of the Club on November 29, 1920, to put forward their recommendations as to the conditions for the Schneider Race, 1921, for seaplanes, and for the proposed International Speed Race for flying machines.

Classification of Machines for Racing Purposes.—It was decided to defer this for the present.

FLYING SERVICES FUND COMMITTEE

A Meeting of the Flying Services Fund Committee was held on Friday, November 26, 1920, when there were present :—Group-Capt. C. R. Samson, C.M.G., D.S.O., R.A.F., in the Chair, Lieut.-Col. Alan S. W. Dore, D.S.O., Mr. Chester Fox and the Secretary.

Applications for Assistance.—Forty-four applications for assistance were considered, and grants and allowances voted amounting to £625 11*s.* 3*d.*

MEETING OF THE RACING COMMITTEE AND THE REPRESENTATIVES OF THE SOCIETY OF BRITISH AIRCRAFT CONSTRUCTORS

A Meeting of the Racing Committee and the representatives of the Society of British Aircraft Constructors was held on Monday, November 29, 1920, when there were present :—

Brig.-Gen. Sir Capel Holden, K.C.B., F.R.S., in the Chair.
Maj.-Gen. Sir Sefton Brancker, K.C.B.
Col. F. Lindsay Lloyd, C.M.G., C.B.E.
Group-Capt. C. R. Samson, C.M.G., D.S.O., R.A.F.

From the Society of British Aircraft Constructors :—
Capt. P. D. Acland.
Com. James Bird.
Capt. G. de Havilland.
Maj. Vincent Nicholl, D.S.O., D.S.C.
Mr. C. K. C. Patrick.
Mr. L. L. Walker.
Harold E. Perrin, Secretary.

Schneider Race, 1921, for Seaplanes.—Recommendations were suggested to be put forward by the Club at the Bureau of the Fédération Aéronautique Internationale at its Meeting to be held in Paris on January 10, 1921.

International Speed Race for Flying Machines.—Certain recommendations were suggested to be put forward in the event of the Fédération Aéronautique Internationale deciding to hold an International Speed Race to replace the Gordon Bennett Race.

COMMITTEE MEETING

A Meeting of The Committee was held on Wednesday, December 15, 1920, when there were present :—Brig.-Gen. Sir Capel Holden, K.C.B., F.R.S., in the Chair, Maj.-Gen. Sir Sefton Brancker, K.C.B., Mr. Ernest C. Bucknall, Mr. G. B. Cockburn, Lieut.-Col. F. K. McClean, Lieut.-Col. Alec Ogilvie, Lieut.-Col. Mervyn O'Gorman, C.B., Group-Capt. C. R. Samson, C.M.G., D.S.O., R.A.F., and the Secretary.

Joint Standing Committee of the Royal Aero Club and Society of British Aircraft Constructors.—Report of Meeting of the Joint Standing Committee of the Royal Aero Club and Society of British Aircraft Constructors held on November 25, 1920, was received and adopted.

The views of the Joint Standing Committee on proposed races in Great Britain in 1921 were referred to the Racing Committee.

Flying Services Fund.—Report of the Meeting of the Flying Services Fund Committee held on November 26, 1920, was received and adopted.

Racing Committee.—Report of Meeting of the Racing Committee with representatives of the Society of British Aircraft Constructors held on November 29, 1920, was received and the recommendations in regard to the Regulations for the Jacques Schneider Cup, 1921, and the proposed International Speed Race to take the place of the Gordon Bennett Aviation Cup were adopted for submission to the Bureau of the Fédération Aéronautique Internationale on January 10, 1921.

House Committee.—Reports of Meetings of the House Committee held on December 6 and 13, 1920, respectively, were received and adopted.

Election of Members.—The following New Members were elected :—

Hubert Adolphus Jordan.
Capt. Frederick Kynaston Wells (late R.A.F.).

Re-Election of Members in Accordance with Rule 41.—On the recommendation of the House Committee, the Members elected for the year 1920 were re-elected in accordance with Rule 41.

Fédération Aéronautique Internationale.—The following delegates were appointed to represent the Club at the Meeting of the Bureau of the Fédération Aéronautique Internationale to be held in Paris on January 10, 1921 :—Lieut.-Col. Mervyn O'Gorman, C.B., Maj. R. H. Mayo amd Mr. H. E. Perrin, Secretary.

The items for discussion include :—
Schneider Race, 1921, for Seaplanes.
Gordon Bennett Balloon Race.
International Speed Race.
Special Brevet (aerobatics) proposed by the Royal Aero Club.
Aerial Derby Around the World.

Aero Club of South Africa.—The affiliation of the Aero Club of South Africa was approved and agreement signed.

British East Africa.—The Royal East African Automobile Association at Nairobi were appointed the Club's official representatives in British East Africa.

International Aviation Insurance.—The report of Maj. E. H. Tindal Atkinson, the Club's representative on the Law Committee of the Fédération Aéronautique Internationale, on the question of International Aviation Insurance, was received and adopted. The Secretary was instructed to forward the same to the Fédération Aéronautique Internationale.

Aviators' Certificates.—The following Aviators' Certificates were granted :—

7906 Harry Redman Coningsby.
7907 Harold Snow Davie.
7908 Christopher Oswald Towler.

Offices : THE ROYAL AERO CLUB,
3, CLIFFORD STREET, LONDON, W. 1.

H. E. PERRIN, Secretary.

CAMBRIDGE UNIVERSITY AERONAUTICAL SOCIETY

(OFFICIAL ORGAN, "FLIGHT")

Rigid Airships *

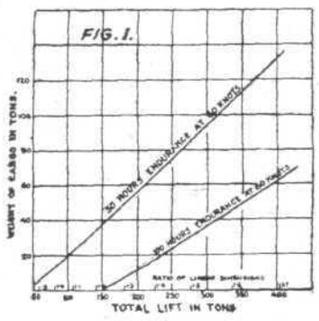
By C. I. R. CAMPBELL, O.B.E., M.I.N.A., F.R.Ae.S.

AN attempt has been made in the following paper to set down some of the various principles and facts which have directed the development of rigid airships.

As this paper deals mainly with airships, whose uses for war are not very extensive, and cannot here be discussed, it is proposed to refer only to aircraft designed and used for peaceful purposes.

1. *Reasons for the Use of Aircraft.*—The decisive reason is to save time in transit of goods or persons. Taking everything into consideration, we cannot expect that air transport will secure adequate public support unless the time taken is at least halved, on the average journey, as compared with competing systems of transport. Adopting this basis, we see that the necessary average speed over the ground would vary from 90 or even 100 m.p.h., where competing with fast railways, to 10 miles an hour or even less in some out-of-the-way parts of the world. Where the highest speeds are required, aeroplanes alone can compete with existing forms of transport, but such cases are surprisingly few, and only occur over a small portion of the earth's surface. Where moderate speeds and endurances of not more than 1,000 miles are required, either H/A craft or airships may be employed. Where moderate speeds are adequate and endurances of over 1,000 miles are required, airships alone can be used.

2. *Airship Speeds.*—In the case of airships, we have the condition that the most economical speed is commonly below that which is commercially desirable: endurance and economy must therefore be sacrificed in order to give sufficient regularity of running. Airships will show to greatest advantage where used over journeys on which their quality of long endurance is called into play. For journeys of, say, 1,500 to 3,000 miles, it very seldom happens that existing means of transport average 25 miles an hour. In most cases airships averaging 50 m.p.h. speed over the ground would fulfil the requirement of halving the time.



Taking the weather conditions into consideration, it is concluded that on long voyages the necessary saving in time can be effected by airships having normal speeds of 65 to 70 miles an hour through the air. For short voyages higher speeds are feasible when desirable, but, generally speaking, the reduction in commercial value of an airship which accompanies increase in speed is so great that the lowest speed adequate to secure traffic will usually be adopted.

3. *Airship Performance.*—Unlike H/A craft, airship performance is greatly affected by size, increase in total lift giving improved performance up to values of the former, almost certainly above 10,000,000 cubic ft. gas capacity (about 300 tons total lift). The reasons for this are as follows:—Roughly speaking, the horse-power per ton necessary for a given speed varies as the two-thirds power of the total lift. This law is fairly correct for airships of, say, 25 tons total lift and above.

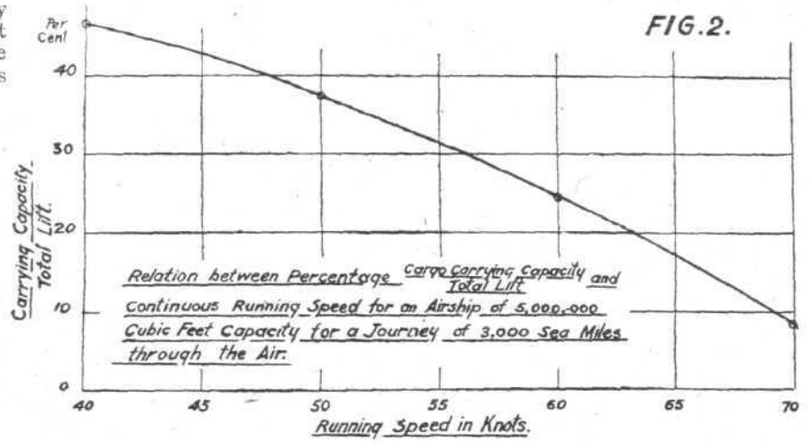
If we start from the smallest airships and consider the effect of increase in size, we find that the weight of machinery per ton of total lift for a given speed decreases at first somewhat quickly, later more slowly, but it never ceases to decrease.

The other fixed weights—hull, fabric, equipment—do not bear any simple relation to total lift. The ratio of the weight of these items to total lift is a minimum at a value of total lift which is not very definite, but which we will suppose to be about 80 tons. Below this total lift the ratio increases at a rate which is accentuated as the smallest sizes are reached. Above 80 tons the increase is slow at first, but over a range of total lift from, say, 150 tons to over 300 tons, is sufficiently rapid to neutralise the steady fall in the proportion of total lift absorbed by machinery weights, with the result that over this range the total empty weight is nearly a fixed proportion of the total lift, *i.e.*, about 40 per cent. in airships having normal speeds of 65 to 70 m.p.h. This does not mean that there is no gain in efficiency to be obtained by increasing size above 150 tons. On the contrary, the steady reduction in horse-power per ton of total lift involves a reduction in the proportion of lift which, for a given journey at given speed, must be allotted to petrol and oil, and enables proportionately more cargo to be carried.

Mention has already been made of the heavy cost of increasing airship speeds. This is shown by the curves in Fig. 2. The loss of carrying capacity is, of course, due rather to the increased weight of petrol than to increased weight of machinery.

4. *Types of Airships for Commercial Work.*—As previously stated, airships increase in efficiency with increased size. Small airships may be used for a variety of purposes, commercial and otherwise, but the more important transport work will almost certainly be done by rigid airships of the largest size.

FIG. 2.



5. *Rigid Airship Types.*—A semi-rigid airship relies for the maintenance of its transverse form mainly upon gas pressure in the envelope. Its longitudinal form is maintained by a rigid, or nearly rigid, longitudinal keel at the bottom of the envelope.

A rigid airship relies entirely upon a rigid framework for the maintenance of its external form. Clearly, between the semi-rigid and rigid types many intermediate types are possible.

The true rigid type is itself capable of many variations. Inventors have usually given excessive attention to the provision of strength longitudinally to resist vertical forces, and have proposed such devices as the use of very strong keels in the lower parts of the hull; or forming the sides of the hull into deep braced girders; or even fitting vertical struts and diagonal wiring along the middle line of the ship, so as to form, with the top and bottom longitudinals, a braced girder the full depth of the ship. In considering these it must be remembered that the hull has to resist the action of very considerable lateral forces when turning. The effect of such forces will be combined with that of vertical forces due to weight and buoyancy. It is apparent, therefore, that the resultant shear forces and bending moments may at times be in a plane more nearly horizontal than vertical, and that the best hull structure will be one suited to withstand such forces and moments acting in any plane through the axis, with the greatest and least strengths in the vertical and horizontal planes respectively. A hull structure having the general characteristics of a tube naturally presents itself as the most scientifically correct, and such a structure is accordingly found in all rigid airships.

* Extracts from a Paper read before the Cambridge University Aeronautical Society on November 24, 1920.

We have now reached the following conclusions, viz. :—(1) That airships have a wide field of commercial utility. (2) That the bulk of airship work will be done by rigids of large sizes. (3) That the type of hull in common use is, on the whole, such as would be reached by a logical study of the requirements, and is therefore sound in principle.

We can now proceed to discuss rigid airships more in detail.

6. *General Arrangement.*—Static stability is of value to an airship under all conditions. It is therefore necessary to place at the bottom of the airship as much of her weight as possible. For this reason, we find the engine cars are all slung from the lower part of the hull. Similarly, all disposable weights such as petrol, water ballast, oil, cargo, etc., are distributed along the bottom of the hull. The fins, rudders and elevators have their combined C.G. nearly at the axis, and cannot be lowered without increase of weight and resistance and reduction of their efficiency. The horizontal distribution of these items is determined as follows :—

The power plant must be divided among several propellers, in order to secure the highest propeller efficiencies. Also at the present moment no suitable engines of high power are

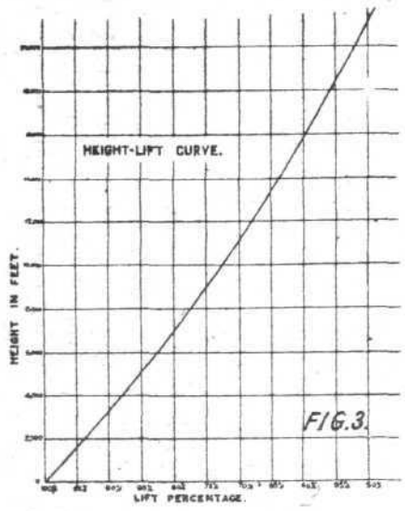


FIG.3.

available. Further, it is necessary to distribute the machinery weights over the length of the ship, in such a manner as to minimise the shear forces and bending moments in the light condition. These considerations lead us to the use of from three to six-power units arranged in the familiar manner. The distribution of the disposable weights calls for no comment except that it must be arranged so as to minimise the stresses in the hull structure under all conditions of loading.

The gasbag arrangement must provide—(1) The greatest possible gas capacity. (2) Freedom from surging of the gas when the ship is inclined longitudinally. (3) Safety of the ship in the event of a hole being made accidentally in a gas container.

No. 1 above is obvious, and we need only remark that 6 ins. or more of air space should be left between the gasbags and the outer cover to permit of ventilation and to reduce superheating of gas. Nos. 2 and 3 result in the use of a number of separate gasbags, no one of which has a capacity more than a certain proportion of the whole capacity of the ship—one-tenth may be taken as a fair proportion.

6 (A). *Form.*—It is fairly certain that the body form of least resistance has no parallel body, and has a $\frac{\text{length}}{\text{diameter}}$ ratio of 6 or less. The values found in some existing airships are as follows :—

Bodensee, as built	6.95
Nordstern	7.5
"R.80"	7.64
"R.33" and corresponding German classes	8.16
"R.38"	8.16

In most cases the designer has not a free hand to select the form of least resistance. He has to consider the limitations of shed accommodation, convenience of handling, reduction in total weight of ship, efficient disposition of power units : the resulting form is therefore a compromise.

7. *Hull Structure.*—The principal forces acting upon the hull are :—(1) Local pressure exerted by each gasbag upon the hull structure surrounding it. This is greatest at the top of the ship, and the resultant vertical component is the lift of the gasbag. (2) Local downward forces due to weights of hull, cars, fins and useful load, etc. (3) Aerodynamic forces, other than propeller thrust. When the ship is moving ahead in an axial direction, these forces are those which constitute the resistance of the ship. When she is turning or not moving axially, the aerodynamic forces have components at right angles to the axis which may produce considerable bending moments and shear forces in the structure. (4) Propeller thrust. (5) Mooring and handling forces.

Nos. 1 and 2 are combined in design to form a load curve for the whole ship, from which by integration we obtain shear force and bending moment diagrams. To obtain the worst conditions we must take account of the fact that the gasbags may not all be equally inflated, and even that one gasbag may be entirely deflated. Added to the forces so obtained, we have at times those due to 3 and 4 or to 5.

In order to cope with the conditions outlined above, the hull structure, as already stated, has the characteristics of a skeleton tube, tapering towards the ends. It consists of the following principal elements :—(*a*) A set of longitudinal girders running continuously from bow to stern. These receive the outward forces exerted by the gasbags and resist, in conjunction with the diagonal wiring of the hull, the general shear forces and bending moments, etc.

(*b*) Main transverse frames spaced along the hull at a distance apart of .4 to .6 of the diameter amidships. Each frame is provided with a set of radial wires or their equivalent to maintain its shape correctly. In addition, each frame has a number of subsidiary wires whose function is to fill in the gaps between the radial wires and to form with them a sort of wire bulkhead, able to support the end of one of the two adjoining gasbags in the event of the other being deflated.

The general arrangement of the structure is such that most of the lift of each gasbag is delivered to the upper joints of the adjoining main frames. These joints are accordingly connected by strong wires direct to the bottom of the hull, where the greater part of the ship's load is situated. (*c*) To complete the main structure and to enable it to withstand shear forces and torsional moments, bracing wires are fitted in all panels of the hull. (*d*) *The Keel.*—The useful load in a large rigid is about 60 per cent. of the total weight, and this is almost entirely distributed along the bottom of the ship. This load is mainly composed of petrol in tanks, water ballast, cargo, passengers, etc., and does not admit of very regular distribution. It should clearly be grouped at the main frames, but this is only partly possible. It is therefore necessary to construct in the bottom of the ship a keel girder whose function is to carry the useful loads and to transmit the weight forces to the points at which support from the hull can be obtained, *i.e.*, to the main transverse frames chiefly and to the intermediate transverse frames in

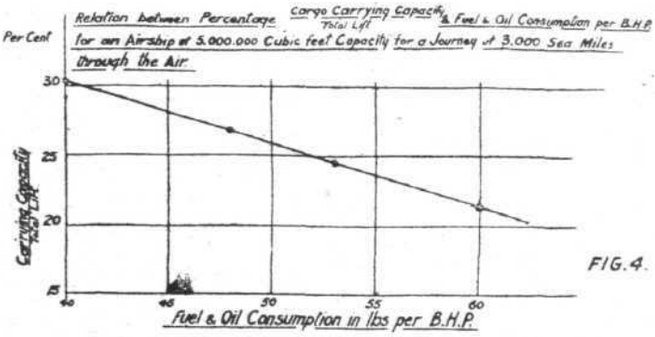


FIG.4.

a less degree. This keel girder is either triangular or trapezoidal in form, the base being formed by the bottom face of the hull, while the sides converge toward the top. All faces of the keel are strongly braced. The minimum height of the keel is that which is necessary for its use as a main communication passage along the bottom of the hull.

8. *Tail, Fins, Rudders and Elevators.*—These are situated as far aft as possible for obvious reasons. As a result the diameter of the hull in their vicinity is relatively small, and considerable ingenuity is, in consequence, required in arranging the stay wires which support them. A recent type triangular section fin has appreciably less resistance than the older form with its stay wires, and is said to be quite efficient aerodynamically.

The form of rudder and elevator plane fitted in most rigids and in the "R.33" class is a nearly rectangular plane pivoting about an axis 25–30 per cent. of its fore-and-aft length from the leading edge, and has the merit of being remarkably well balanced through angles up to 20 or more degrees on each side of the central position. This is important, as these planes are operated by hand-power only. This form of plane is, however, not the most powerful in operation, and in later

ships a form approximating more to what is known in ships as the cruiser type of rudder is being fitted.

9. *Outer Cover.*—The primary function of this is to exclude wind, moisture, and the sun's radiation from the interior of the airship, and to present a smooth, fair surface to the passing air during flight. The material used is, commonly, doped cotton fabric made up into large sheets which are laced tightly to the hull girders. In recent ships the sheets are placed with their length fore and aft, while their width is such as to span the distance between adjoining main longitudinals. As the curvature of the hull in a longitudinal direction, even near the ends of the ship, is relatively slight, this arrangement greatly facilitates thorough and uniform stretching of the sheets.

The sheets are doped in place, so as to give them the desired final tension, and also to ensure that they have a surface perfectly impervious to moisture. Aluminium powder is mixed with the last coat of dope to reflect the sun's rays as far as possible, and any rays which pass this are absorbed by pigment in the second coat of dope. Further, the aluminium and pigment greatly improve the weathering qualities of the dope. The light rays are excluded because some of them are injurious to fabric; the heat rays because they heat the gas in the gasbags and so give the ship a temporary "false lift."

Doped fabric is not a perfect material for outer covers, and it is often suggested that thin metal sheeting should be used instead. The weight of metal would, however, be prohibitive, and, on the whole, it appears that we have no good substitute in view for the doped fabric, but this will undoubtedly undergo many improvements.

10. *Gasbags.*—These are made of very light cotton or silk fabric lined with goldbeaters' skins, which are finally given a coat of protective varnish. The use of skins seems to be a somewhat primitive method, but nothing better has yet been devised. This is a problem for chemists to solve.

Gasbags are made as light as possible, and have no great strength to resist bursting: they must therefore be supported over the whole of their surfaces by wires or cords spaced from 12 to 18 ins. apart.

In order to understand the conditions under which the gasbags work, a few remarks upon the variations of pressure during flight may be of assistance:—

The atmospheric pressure, temperature, and density all fall fairly steadily as we proceed from a lower to a higher altitude. Suppose an airship to be flying steadily at a certain height with her gasbags, as usual, only partly full. If now she ascends slightly, she passes into a region where the atmospheric pressure is slightly less than before, and consequently the gas in her bags expands to a small extent and the bags become fuller. If the ascent is continued, the bags will eventually become quite full and gas will begin to escape from the automatic relief valves. A good deal of experience in construction work is necessary before it is possible to arrange the structure and gasbag supports so that movement of the gasbags can take place without fear of damage to the light fabric. Very much depends upon the absolute reliability of the automatic gas valves. The design of these valves is a matter of some difficulty owing to the low pressure, say 2 to 3 lbs. per sq. ft., at which they must open freely. The valve discs are about 32 ins. in diameter, and are spring-loaded. When there is no pressure in the bags, the valve rim is pressing upon its seat with a force of only from 2 to 3 ozs. per inch run, and leakage is therefore difficult to prevent. A small leakage of hydrogen outward would not be important; the real trouble is that leakage of air inward is liable to occur when the bags are only partly full. It will be seen that the problem is difficult, and we must admit that a perfect solution has not yet been found.

11. *Machinery.*—As already mentioned, the machinery is divided into a number of separate units, each unit being carried in a car slung from the underside of the hull. Each unit consists of one or two engines driving, through disengaging clutches and reduction gearing, a pusher propeller at the after end of the car. Each engine has its own radiator, water-pumps, etc.

The reduction gear involves a small loss of efficiency of perhaps 1–3 per cent., but it enables a considerably higher propeller efficiency to be obtained, especially when running with only a proportion of the engines working. The reduction gear is somewhat heavy, but for long voyages a saving in petrol consumption results from its use which more than offsets its weight. It is possible that the reduction gear could be dispensed with if slower-running engines are used in conjunction with higher airship speeds.

The petrol system consists of a number of containers carried in the corridor, all of them connected to one or two petrol mains running along the bottom of the corridor and connected to each of the power cars by small petrol supply-pipes.

The propellers are of the two-bladed type, not only because somewhat greater efficiency is thereby obtained, but because the power cars come very close to the ground when the airship is landing, and with two-bladed propellers it is possible to place the blades horizontal and therefore clear of the ground. As regards future improvements in the machinery installation, it is to be noted that, with most of the engines hitherto used, the petrol consumption is over .5 lb. per h.p. hour, and this is obtained at full power only. At lower powers the consumption is usually higher. In airships, as in other types of ships, engines are not usually run at more than three-quarters full power. There can be no doubt that engines can be produced giving a fuel consumption of not more than .45 lb. per h.p. hour at three-quarters full power, and this will enormously increase the cargo capacity of a given airship upon a given voyage. Possibly some fuel other than petrol will come into use with some other cycle of operation.

Propeller efficiency does not afford much scope for improvement, as it is already high, but great advantages would result from the introduction of a reliable variable-pitch propeller, capable of being used for reversing.

At present, the consumption of petrol and oil by the engines during the progress of a voyage causes the airship to become steadily lighter, and consequently to lose gas. On a long voyage this may result in 25 to 30 per cent. of the gas in the ship being lost. The petrol in course of combustion in the engines combines with the oxygen of the air, and the water-vapour so formed will, if condensed, give a weight of water greater than the weight of petrol burnt. If an apparatus to effect this can be developed successfully and fitted, it will enable an airship to take a long voyage with very little expenditure of hydrogen indeed, and will effect a considerable saving in cost, while contributing appreciably to the safety of the airship in the later stages of her voyages. It is, however, possible to overrate the importance of the apparatus.

12. *Terminal Requirements.*—Experience of handling airships upon the ground under various weather conditions indicates that this will never be desirable or safe in really strong winds. Airships can be prepared for a voyage and started off at one terminal, and at the other end of the journey moored and unloaded, without handling upon the ground, by the use of the mooring mast system, which was first worked out by Air-Commodore Masterman in conjunction with Messrs. Vickers, Ltd. With this system an airship does not come to ground at all under ordinary circumstances. When preparing for a flight she is moored by the nose to the top of a mast over 100 ft. high. Before starting she is given a slight excess buoyancy, her nose is released from its attachment to the mast-head, and she promptly rises freely. On arriving at her destination, where a similar mast must also be situated, she is brought to within 200 or 300 ft. of the ground, and the end of a long wire is dropped from her nose to the ground, where it is coupled by ground-men to the end of a similar rope which passes over a sheave at the mast-head to a winch at the foot of the mast. By winding steadily in with the winch, the slack of the ropes is taken in, and eventually the nose of the airship is pulled in to the mast-head and secured to a special coupling, which allows her to swing freely round the mast as necessary to keep her bows on to the wind. This system has not yet been quite fully developed, but the experiments which have already been made with "R.24" at the Pulham mooring mast show quite conclusively that the system is successful. When moored to a mast, an airship can ride out any weather met with in this country, except snowfalls. A heavy fall of snow will force an airship to take to flight until, at any rate, some means is found of preventing the snow from accumulating on top of the hulls and fins and so overweighting the airship.

The great merit of the mooring mast is that, as the airship does not normally come to ground at all, a large landing party is not required, all that is necessary being a small staff to attend to the mast gear. On the few occasions when an airship must be taken into a shed, a landing party can be specially engaged. One of the main expenses of airship running has therefore been abolished. A system which has not yet been tried, but which may have value in special localities, is that of mooring an airship to a mast situated in a stretch of tideless water. The airship would rest upon floats in the water, and would be moored by the nose to the mast, which would be only 50 or 60 ft. high. This system would, however, not be suitable for localities where the water would be liable to freeze.

There are, of course, other variants of the mooring mast, but the essential point to note at present is that we do know one form of mast which fulfils the requirements.

13. *Future Developments.*—It is, perhaps, dangerous to attempt to prophesy, but it is none the less well worth doing.

In looking to the future, we may assume that in the course

of a few years many things will change. People will become accustomed to air travel, and will welcome increasingly the saving in time which it gives. Meteorological science will advance far enough to enable air voyages over regular routes to be made with safety and regularity. Airships of 5 to 10 million cubic ft. capacity will come into use, and, with improvements in design, materials and machinery, will be capable of running on long voyages of 3,000 to 6,000 miles at speeds of 60, carrying cargo and passengers totalling 20 or even 25 per cent. of the total lift. At the terminal stations mooring masts of 200 ft. or more in height will be erected, and airships will be able to moor and unmoor to these in any winds in which flight is advisable. These masts will be fitted with lifts for passengers and cargo. The airships will have large cabin spaces 300 ft. or more in length, fitted in such a manner as to give all reasonable comforts to passengers

ROYAL AERONAUTICAL SOCIETY NOTICES

Transactions.—A new volume in the "Transactions of the Royal Aeronautical Society" has just been published, and may be obtained at the Society's offices, price 5s. It embodies a paper on "Aero Engine Efficiencies," by Dr. A. H. Gibson of Manchester University, which contains a large amount of important experimental data on the thermal efficiency of internal combustion engines.

Scottish Branch.—The Members of the Scottish Branch, through the courtesy of Sir William Beardmore, Ltd., recently visited this firm's works at Inchinnan, when they were given an opportunity of examining the new rigid airship "R. 36," which is in process of construction for the Government.

New Year Outing.—It is hoped to arrange early in the New Year for a number of Members to visit an important centre of aeronautical experimental work. Further details will be announced later.

Donations.—The Council desire gratefully to acknowledge the gift of "Rigging, The Erection and Truing-up of Aeroplanes," by F. W. Halliwell, the author, and also the gift of lantern slides from Messrs. The Bristol Aeroplane Company.

Library.—The following books have been received and placed in the Society's Library:—"Soaring Flight," by Lieut.-Col. R. de Villamil; "Report of the Lubricants and Lubrication Inquiry Committee"; "Smithsonian Physical Tables," by Frederick E. Fowle.

W. LOCKWOOD MARSH,
Secretary

Death

Official intimation has been received that Flying Officer Ian McDonald, M.C., D.F.C., was killed on active service on September 22. It appears that the machine in which he was flying was seen to fall in the river at Samawahon on September 22, having apparently been shot down while its occupant was dropping food on the defence vessel *Greenfly*, which had stranded. Flying Officer McDonald was seen to wade ashore, and was taken prisoner, and from a subsequent report he is known to have been killed at Dangatora. The only son of the Hon. Donald McDonald, member of the Legislative Council of the Leeward Islands, and of Mrs. McDonald, of Antigua, he joined the R.F.C. from school in 1916, when only 17 years of age. Going to France in the following year, he attained to the rank of captain, and received the M.C. and the D.F.C., after accounting for 20 enemy 'planes. He returned to Antigua after the Armistice, suffering from eye-strain, but afterwards came back to England, and, receiving a permanent commission, was selected as flying instructor at Cranwell. He left for Mesopotamia early in August.

Married

Mr. AUBREY BEAUCLERK ELLWOOD, D.S.C., R.A.F., youngest son of the Rev. C. E. and Mrs. Ellwood, Cottesmore Rectory, Oakham, was married on December 11 at Bombay, to LESLEY MARY JOAN, elder daughter of Mr. and Mrs. W. P. MATTHEWS, The Old House, Walmer, Kent.

To be Married

The engagement is announced of Flight Lieutenant COLIN WARD SYLVESTER CHALMERS, R.A.F., younger son of Mr. and Mrs. J. H. Chalmers, 4, Cavendish Place, Bath, to AUDREY KATE MERVYN, elder daughter of Mr. and Mrs. MERVYN F. VOULES, Cordwalles, Camberley.

A marriage has been arranged, and will shortly take place, between Flight-Lieut. ROBERT ANDREW GEORGE ELLIOTT, R.A.F., Medical Service, eldest son of the late George Elliott, J.P., and Mrs. Elliott, of Aavagh, Cavan, and GEORGINA, second daughter of the late THOMAS EDWARD BAKER and the late Mrs. BAKER, late of Maythorne, Tenbury-Wells.

A marriage has been arranged, and will take place very shortly, between the Rev. HUGH MCCALMAN, M.C., R.A.F., only son of Lieutenant-Colonel and Mrs. McCalman, and RUTH MARJORIE, elder daughter of Mr. E. HUGONIN and the late Mrs. A. HUGONIN.

An engagement is announced between ANDREW REGINALD WEBSTER, late R.A.F., younger son of the late Mr. G. M. Webster and Mrs. Webster, of Montreal, Canada, and LILIAN, second daughter of Mr. and Mrs. T. ARATHOON, of Caversham Court, Oxon. The marriage will take place early in January at St. Peter's Church, Caversham.

A Handley Page in the Irish Sea

LLOYD'S agent at Holyhead on the evening of December 17, telegraphed:—

"Aeroplane Handley Page J. 2559 reported dropped in the sea 15 miles north-west of Holyhead. Steam lifeboat proceeded to render assistance. A later report received states that the crew have been picked up by a passing steamer bound for Liverpool."

It appears that the machine belonged to the R.A.F. and was flying from Chester to Holyhead, and engine trouble occurred when about 12 miles out at sea. A wireless message was sent out, the aeroplane came down on the water, and after the seven occupants had been sitting on the wings for 2¼ hours, they were picked up by the Elder-Dempster liner "Itajahy," and landed at Liverpool. Fifteen minutes after the crew was rescued the machine sank.

An Opportunity in Canada

ANOTHER opportunity for an ex-service man who is qualified to supervise an aero-engine repair section occurs with the Air Board of Canada. Those who are interested in this vacancy will find details in an advertisement under the heading of Situations Vacant on page xiv.

The Ex-Service Men's Carnival at White City

OF the three holders of the Victoria Cross, representing the three services, who took part in the opening of the Ex-Service Men's Winter Carnival and Exhibition at the White City on December 18, Flight-Lieut. F. M. F. West represented the R.A.F., L.-Cpl. W. R. Parker, R.M.L.I., the Navy, and Capt. E. B. Towse, the Army. Half the profits of the organisation are to be handed over for the benefits of the funds of ex-Service men of all ranks.

AIRISMS FROM THE FOUR WINDS.

A NAVAL correspondent of *The Times*, in commenting upon the Jutland papers "and after," points out that, "although Admiral Jellicoe does not mention it in his narrative, the *Campania*, a kite-balloon ship and aircraft carrier, was apparently intended to accompany the Fleet. Indeed, she actually put to sea for the purpose, but for some reason which is unexplained she was ordered, at 4.37 a.m. on the day of the battle, to return to base. As a consequence, the cross-Channel steamer *Engadine* was the only aircraft carrier present, and she only at the beginning of the battle-cruiser action."

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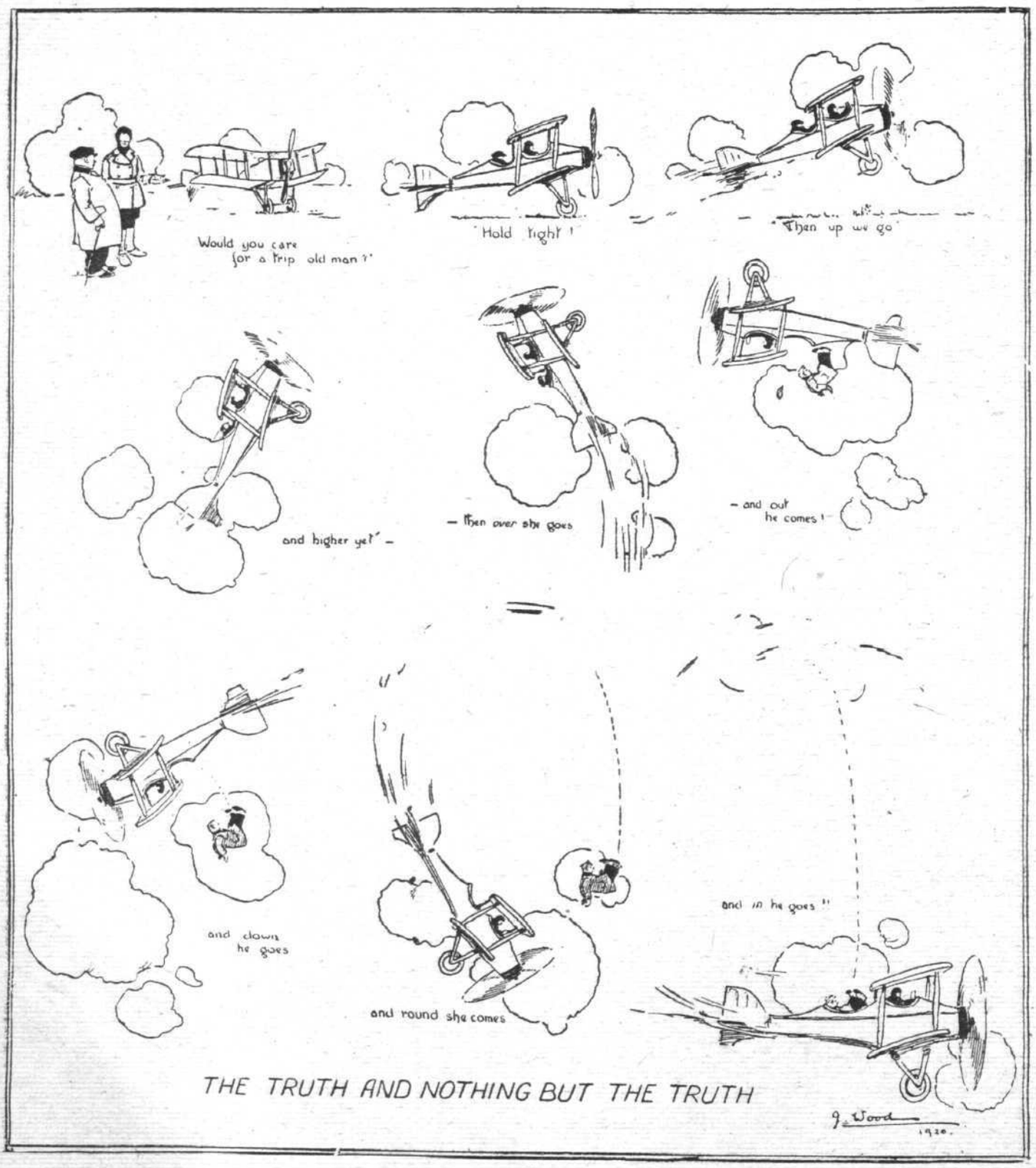
AMONGST the rush of contributions to the varied opinions as to capital warships, submarines, aircraft and guns for future war contingencies, a reasonably argued scheme has been put forward by "Breechscrew" in the *Evening Standard*. He says :—

"The bomb carried by aircraft has a range equivalent to



that of the aeroplane carrying it, but accuracy, or even anything approaching accuracy, in dropping bombs from the air has not yet been attained.

"Once real and consistent accuracy has been reached the gun may have to be shelved, and the ship with it, but this refers to tomorrow, not today.

"Granted, then, that the gun has to remain for the present, what ship is to carry it—and is this ship to be a small or large one? The gun must have a steady platform, or its comparative accuracy will disappear—the ship must therefore be a large one, and such an advance must be made in the design of this ship and its guns that we shall be as far in front of our rivals today as we were when the first Dreadnought was launched."

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"How is this to be brought about?" "Breechscrew" asks. "The answer is, by aircraft: this may appear to be a curious reply, but it is nevertheless a strictly correct one.

"Battles are won, and will be won, by that side which is able, owing to the superiority of its armament, to hit its adversary, and keep on hitting him, and yet remain itself immune.

"At the present time such a desirable state of affairs from our point of view can only be attained by mounting the Big Bertha type of gun on the fastest ship, with the most up-to-date anti-torpedo devices that can be devised.

"Such a ship will immediately cause the scrapping of all existing types, and we shall be ahead again—until such time as the Navy is absorbed by the air.

"Now the building of such a ship carrying guns with a range of about 40 or 50 miles is made possible only by the advent and development of the aeroplane, because the ship will have to rely solely on the aeroplane for observation of fire or 'spotting,' as it is called.

"The ship will be blind; it will not see the targets its guns engage; all directions as to ranges, bearings and corrections for these will come from the aircraft, by wireless and directional wireless. Indirect fire was, as every soldier knows, the normal method of shelling used in France and elsewhere during the War by our artillery, spotting being done by Artillery Observation Flying Squadrons."

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"THE idea is, therefore, no foolish one," continues "Breechscrew," "but a sound, reasonable and proved proposition.

"In addition the aircraft will render invaluable assistance in the protection of this big gun ship, and the result of sea warfare in the immediate future will depend solely upon air supremacy. For every two or three big-gun ships that are ordered, at least one aircraft-carrier will be necessary, and steps should be taken immediately to decide upon the types of aircraft to act as spotters for the Battle Fleet.

"Only by a whole-hearted and concentrated effort now can we hope to lay the foundations for the solving of this question. A few years hence, after much patient observation and probably some bitter experiences, 'Scrap the lot, and transfer the Navy to the Air,' is a saying that will undoubtedly become our policy—but the time is not yet.

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SURREY justices have the reputation of being merry wits—at other folks' expense. Kingston is well famed for its exploitation of motorists in this connection, the moral as a rule being pointed with anything up to "£10 or a month." Mortlake justices also appear to have a great unpaid of the joke-with-deeficulty order in one Sir James Szlumper, its chairman, who apparently aspires to run his neighbouring Bench, not to say Mr. Justice D——, pretty hard for the "cap and bells." This great personage and his brethren were the other day kept waiting a short time for a prisoner whose case was down for hearing. From a remark by the Divisional Inspector in the Court it would seem that the sudden and big snowfall and the consequent state of the roads were probably the cause of the delay, as the accused had to be conveyed from Wandsworth for the honour of an interview with the great great. But Sir James was taking no back-chat of that calibre. After a lengthy Y.M.C.A. lecture to the Inspector in particular and the police in general upon the enormity of keeping the Bench waiting—wonder if J. S. has ever had experience in waiting as a juror or a witness—the chairman crushed all further argument flat with the following illuminating remarks:—"I don't care how the prisoners are brought here so long as they are here when we want them. You can bring them by aeroplane if you like. I repeat that the Home Office officials and the police are well paid. We are not."

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AFTER all, an article is generally said to be somewhere about the value you pay for it, and therefore—but anyway has the Mortlake Court House a flat roof for an aeroplane to alight on, bird-like, or has Sir James in mind an entrance by the window?

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REGARDING the Jutland discussion and the future of this Empire's power, Lieut. Guy E. Cooper, R.N. (retired), is amongst those who plead for a little light upon the aircraft side of future power, and at the same time he names an historic anniversary—December 21, 1914, the first German Aeroplane Raid—and gives details of happenings six years ago last Tuesday, which we do not remember having seen before. Lieut. Cooper in his letter sets out that "I venture to draw your attention to the anniversary of an event of which I was one of the few witnesses, and which—to the best of my knowledge—has never been brought to the notice of the public.

"On December 21, 1914, a German aeroplane dropped two bombs in the sea off Dover Breakwater, and this was the first attempt in history to attack the British Islands from the air. I was at the time officer of the watch in H.M.S. *Afridi* patrolling off the port, and on seeing the explosions in the water connected them with the aircraft overhead and gave the alarm. We then opened fire on the enemy with the 12 rifles which were our sole anti-aircraft armament. This fire was inevitably ineffective, but none the less it was the only attempt made to harass the raider.

"The naval authorities at Dover saw the splashes, and requested the military not to carry out target practice so close to the harbour entrance. The military authorities informed the Navy that, apparently, a ship at sea had fired two shots toward the harbour. The anti-aircraft defences saw the hostile aircraft, but thought it was a British machine which was expected on its way to France, and such is the natural inertia of the human mind that the captain of another destroyer, who passed close to us while we were engaging the enemy, said subsequently that he couldn't make out what on earth we were doing firing a *feu-de-joie* in the air. Yet everyone concerned had known for long that an air raid on Dover was possible."

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"Now, surely," continues Lieut. Cooper, "the moral of this little story is that a change in the conditions of warfare is not formally ushered in with the pomp and ceremony of a general action. The first attack by air on the British Islands was a fact of such intrinsic importance that it might have been expected to be impressive; yet the details were so petty, the results so futile, that it was shrouded in a haze of misunderstanding, and had the War ended immediately afterwards the significance of the event would have been utterly lost.

"Goethe once said of Valmy that 'we entered on a new world then,' but on the night of September 20, 1792, no one in the sodden bivouacs under Argonne realised that the armies of the Revolution had commenced their victorious progress. I would therefore plead that, while it is very proper attention should be concentrated for the moment on the special instance of Jutland, such concentration should not lead to any neglect of the general problems which confront those who must be prepared to wage naval warfare in the future. These problems lose neither their urgency nor their difficulty as a result of the publication of the Jutland Report."

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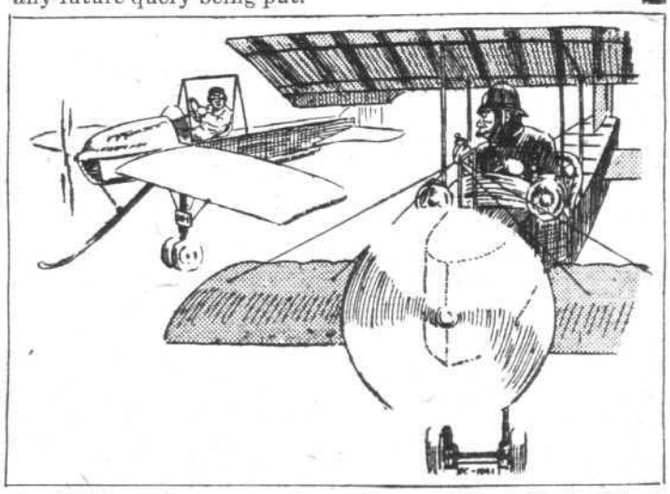
SEVERAL times the question has been raised as to the date of the *first* enemy aeroplane raid on this country. The above incident should certainly be well in the running in case of any future query being put.



Aerial Trappist, somewhere about 1925: "Shall I 'ead 'im hoff himmediately, or wait till 'e gets goin' above th' two-'undred m.p.h.?"

AVIATION IN PARLIAMENT

The Supplementary Estimate

On December 14, on a supplementary estimate of £1,935,000 for the Air Service,

Mr. Churchill said the supplementary estimate would not have been required but for the fact that the Ministry of Munitions had a claim against the Air Ministry on account of their under-estimate of the cost of winding up the war contracts last year. The vote involved no new charge to the State. It was entirely a book-keeping transaction between departments. But for this the Air Ministry would have shown a substantial surplus, partly due to underspending and partly due to savings, the result of long and laborious administration; and they would have been in a position of handing back about £1,500,000 to the Exchequer.

The financial record of the Air Ministry during the year would bear the strictest scrutiny. In July it was decided to add five new squadrons to the strength of the R.A.F. These five squadrons were considered necessary because of the state of affairs in the Middle East, and because of the need of having a reserve which could be sent to any threatened quarter. But because additional overhead charges were not required those five squadrons cost only five-eighths of what other squadrons of the Air Force cost.

Another item of increase had been the additional expense incurred through the conditions in Mesopotamia, Constantinople, and Ireland. In Mesopotamia they had had for many months conditions of actual war, and the number of air squadrons had to be doubled. In Constantinople they had to supply the Air Force which was necessary to assist the troops not only of our own country, but of other countries, in holding that city pending the general settlement by the Supreme Council of the League of Nations. In Ireland they had also been put to additional expense, although not to any great extent. Other increases which had taken place were automatic owing to the rise in wages and the cost of materials.

All those increases have been more than set off by decreases. There were deliberate economies and underspending. Throughout the year the need for the utmost frugality had been borne in mind. Personnel had been allowed so sparingly to the squadrons as to give rise to serious doubts as to whether efficiency and safety had not been imperilled. The training of the Air Force Reserve had been postponed, and acquirements in material cut down to a minimum. A considerable building programme had been planned in order to house the force, but that had been enormously reduced, because it was found that by a certain amount of reconditioning a good many years' work could be got out of many of the temporary buildings they had on their hands. They had also stopped with great regret all the long-distance experimental flights.

Not only had the R.A.F. discharged all its functions out of the ordinary votes of the year, but it was preparing to hand over to the Treasury a sum of approximately £1,500,000 out of the money taken at the beginning of the year. Everything had been scrapped, skimmed, strained, winnowed in the interests of reducing to the least possible dimensions the charge upon the taxpayer, and it was rather hard upon officials who had been labouring in that way and expecting to be complimented upon their performance to find all the fruits of their labour swamped by an enormous deadweight charge outstanding from the past over which they had no control. The only reason why they came before Parliament was to ask for a further sum to wind up contracts by the Ministry of Munitions in order that the money might be handed back at the end of the year as part of the surplus of that department.

When the war came to an end the outstanding contracts of the Ministry of Munitions for air production amounted to £162,000,000. As the result of a careful survey they escaped from £77,000,000 worth of contracts, and they settled for £85,000,000 worth. That settlement partly took the form of compensation to people whose contracts were cancelled and partly the form of taking delivery of certain of the best class of engines to the value of £23,000,000. The estimate which the Ministry of Munitions gave for winding up this business after April 1, 1919, was £17,150,000 last year and £3,250,000 this year. The Air Ministry took those figures in their estimates, but the Ministry of Munitions now notified them that the charge for last year should have been £20,500,000, and for this year £3,500,000. It would thus be seen that the Air Ministry had to provide £3,250,000 more to defray the liquidation of war contracts.

Sir D. Maclean said the main point which seemed the to him to come out of estimates was as to the additional five squadrons. He understood that the need for these was the necessities of the campaign in Mesopotamia, with operations in Constantinople, and the additional requirements in Ireland. In so far as the economies which Mr. Churchill had indicated had been effected he congratulated the officials concerned. He recognised that some real saving had been effected.

Lieut.-Col. J. Ward asked whether it was true that many large buildings on Salisbury Plain connected with the Air Force were to be scrapped while plans had been drawn up for extensive alterations and additional buildings at the Andover Aerodrome, which was on private property.

Lieut.-Com. Kenworthy asked whether any steps were being taken to form a territorial reserve for the Air Force.

Mr. Churchill: I am taking a little money for it in the estimates of next year.

Lieut.-Com. Kenworthy asked whether real steps were being taken to form something analogous to the Royal Naval Reserve among the commercial flying pilots. He also asked what was being done to strengthen the air defences of Singapore. He also asked for information as to the actual system of liaison between the staffs of the Admiralty and the Air Ministry. With regard to the two magnificent ex-German airships, "L 71" and "L 64," that had been handed over to us, he wished to know whether these airships were being used and whether there was any plan for offering them to any commercial airship company. Was any such company in this country prepared to take them over?

Mr. Churchill: I wish there were.

Lieut.-Com. Kenworthy went on to suggest that a subsidy should be offered for the running of the Zeppelins. He concluded by asking whether any progress was being made with helicoptere experiments.

Mr. Billing said when the war ended there was material available for the formation of a great aerial reserve, and a wonderful personnel of pilots The Irish mails could be carried today more cheaply by air than the cost of the subsidy paid for mail boats. There was no reason why the Air Ministry should not have sold machines to some of the officers instead of selling material of about £50,000,000 to a number of City financiers for £600,000. And the Government having sold machines for £20 or £30 went and bought others from manufacturers at a cost of £4,000 or £5,000. The administration of the air service for the past year had not been good. There were aerodromes scattered all over the country that looked like lost cities, and yet the Ministry went and started new schools. Priceless German aeroplanes were being destroyed which could be brought to this country and disposed of.

Mr. Churchill, replying, said that Mr. Billing had reproached him for having too much fish to fry. His trouble was not that he had too much fish, but too little batter to fry it in. When he had supplied the minimum plant for the schools and the minimum number of squadrons needed in the various theatres he was down to the last penny he was in a position to ask Parliament to give. Next year he hoped to be able to reserve some money to encourage civil aviation, which was so essential to the future of the air service. The gravity of the need was borne in upon him by the news of the recent disaster. Many of those who had been engaged flying had retired elsewhere under conditions which were very disappointing, but he was confident that in the end aviation would realise all the hopes of its most enthusiastic supporters.

Mr. Billing moved that the vote be reduced by £100, but this was negatived and the vote was agreed to.

Aero Engines for the R.A.F.

MR. RAPER, in the House of Commons on December 14, asked the Secretary of State for Air how many new aero engines of each different type have been destroyed since the Armistice, and at what prices the same have been and are being offered for sale?

Mr. Churchill: The answer to the first part of the question is, that no new British or Allied machines have been intentionally destroyed under orders from the Air Ministry. The second part of the question does not, therefore arise.

Mr. Raper: Does the right hon. gentleman's reply refer to all aero engines after the removal of their component parts?

Mr. Billing: On what information does he base that calculation? Is he not aware that hundreds of new machines have been taken out of the various aerodromes, the engines removed, and the machines burned since the Armistice? Will the right hon. gentleman take steps to obtain more accurate information?

Mr. Churchill: I have every reason to believe that my answer referring to engines is correct. I am informed that no new British or Allied engines have been destroyed under the orders of the Air Ministry. It is quite true that a number of aeroplanes accumulated during the latter part of the War have been reduced to their component parts, and I expect that we should have been very much complained of if great expense had been incurred on a large staff in keeping these machines in order.

Mr. Billing: Is the right hon. gentleman aware that the Government have only recently accepted the delivery of machines identical to those which have been destroyed?

Mr. Churchill: Yes. That is all part of the general settlement of contracts arrived at when the War came to a close. A settlement had to be made at that time, including the dispersal of those artificially brought into the aeroplane industry.

Mr. Billing: Are we to understand that the Government policy is to accept delivery of materials and then burn them in order to keep men employed?

Mr. Churchill: That would be about as extravagant a policy as the ingenuity of any hon. member could suggest.

Mr. Raper: Does the right hon. gentleman refer to engines or the auxiliary parts of engines?

Mr. Churchill: As far as I know that is so, but if my hon. friend has something in his mind which is not covered by my original answer and he will let me know what it is I will enquire.

Aero Engines Delivered Since Armistice

MR. RAPER asked the Secretary of State for Air how many aero engines of each different type the Government have taken delivery of since the Armistice and what prices have been paid for the same?

Mr. Churchill: A large number of aero engines were, of course, on order at the date of the Armistice. It was necessary to take delivery of 14,800 of these as the contracts could not be broken. These engines were of 28 different types, and varied greatly in price. My hon. friend will find that I shall refer to the finance of this matter when dealing with the Supplementary Air Estmate this afternoon.

Aircraft Carriers

MR. BRIANT, on December 15, asked the First Lord of the Admiralty what is the number of aircraft carriers in full commisson; in commission in reserve; the number paid off; the number scrapped since the Armistice; and the number building?

Sir J. Craig: The numbers of aircraft carriers in full commission, in commission in reserve, and paid off are shown on pages 701 to 714 of the Navy List. The number scrapped since the Armistice, *i.e.*, sold for breaking-up purposes or otherwise, is 4. The number in course of completion is 2.

R.A.F. Uniforms

MR. HOHLER, on December 16, asked the Secretary of State for War with how many different uniforms has an officer who joined the Royal Naval Air Service and was transferred to the Royal Air Force been obliged to provide himself up to the present time; and what has been the approximate cost of such uniforms?

Mr. Churchill: An officer who joined the Royal Naval Air Service and who was subsequently transferred to the Royal Air Force has had to provide himself with the following uniforms:—

Royal Naval Air service uniform,
Royal Air Force service dress,
Royal Air Force mess dress.

The cost of the Royal Naval Air Service uniform was, approximately, £20 The Royal Air Force service dress and mess dress cost, approximately, £25 and £23, respectively. The Royal Air Force service dress was changed from khaki to light blue, and from light blue to a darker blue, but officers were not bound to purchase any uniform of the new colour until their existing uniform required renewal.

Mr. Hohler asked the Secretary of State for War whether officers of the Air Force have recently been compelled to buy mess dress; whether the cost of it is approximately £23, without distinction; and whether any allowance has been made to officers up to the rank of flight-commander in respect of this expense?

Mr. Churchill: Officers granted permanent Royal Air Force commissions, those granted short service commissios and officers promoted from the ranks who are retained in the Royal Air Force for a definite period have been instructed to provide themselves with mess dress. The approximate cost is £23. The answer to the third part of the question is in the negative.

Ex-R.A.F. Men Killed in Ireland

MR. PENNFATHER asked the Chief Secretary for Ireland how many of the police murdered or wounded by the rebels in Ireland were ex-Service men and the regiments to which they belonged?

Sir H. Greenwood in his reply stated that in the total of 45 killed were seven formerly belonging to the R.A.F.

R.A.F. Uniform Allowance

MR. HOHLER, on December 17, asked the Secretary of State for Air whether officers in the Army have recently been allowed £150 uniform or kit allowance less any amount received on joining; whether the same, or any amount has been, or will be, allowed to all officers of the Air Force; and if not, the reason?

Mr. Churchill: As regards Army officers, an allowance of £150 will be made subject to certain conditions to officers joining the Household troops. For officers joining other regiments in which full dress is not worn, the rate will be £50, subject to conditions about to be announced. The question of an allowance for uniform in the case of officers of the Royal Air Force is under consideration, and it is hoped that an announcement on the subject will shortly be made.

FLIGHT

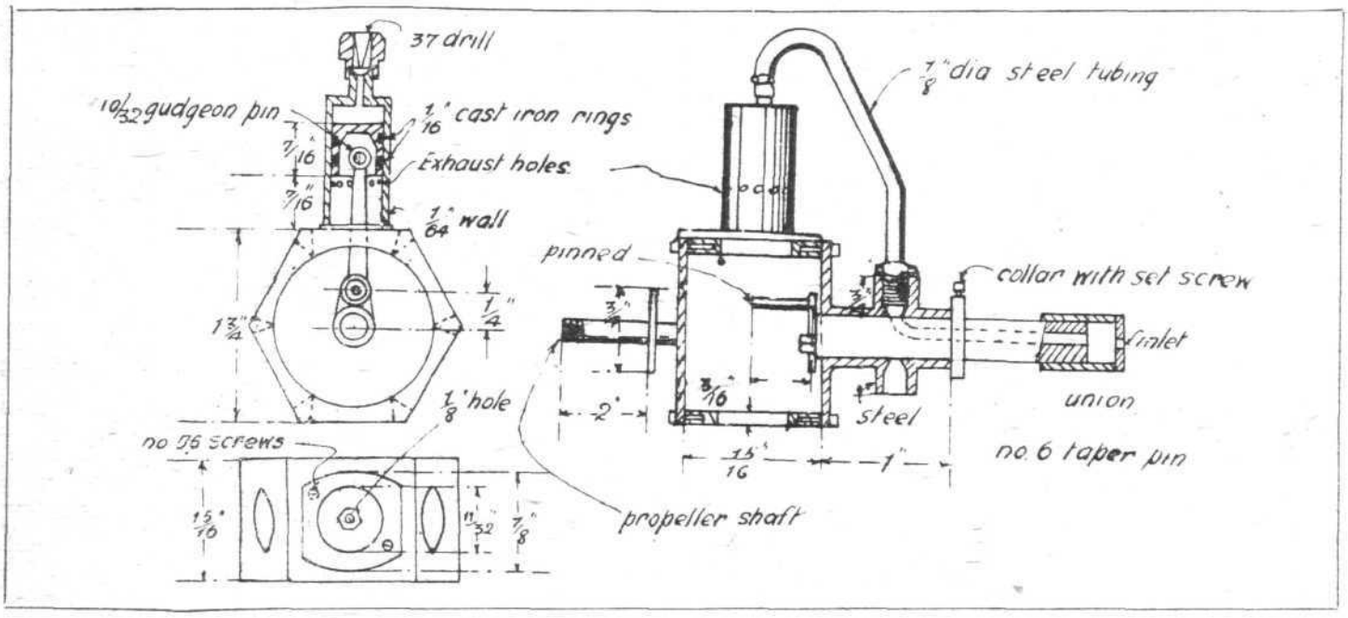
MODEL AEROPLANES

NOTE.—*All communications should be addressed to the Model Editor. A stamp should be enclosed for a postal reply*

The Bohabog C-A. Motor

DETAILS have recently been sent me from America of the Bohabog compressed-air motor, general arrangement drawings of which are herewith given. The motor is six-cylindered.

The cylinders are machined from steel bar and are ½ in. bore and stroke, machined to the dimensions and contour indicated. The pistons are made of cast iron, using two $\frac{1}{16}$-in. cast-iron rings to each piston. The crank-case is made of aluminium and is machined from a hexagon of that material 1¾ ins. across the flats and finished $\frac{15}{16}$ in. wide.



Sufficient stock must be allowed for finishing the sides. The internal dimensions need not be adhered to, the main thing being to allow plenty of room for the sweep of the crank and connecting rods. The boss on top of the cylinder is machined with a $\frac{10}{32}$ thread and a simple coupling nut or union fitted thereto. This serves to accommodate the ⅛ dia. steel tubing that conveys the air from the distributing valve ring to the top of the cylinder. Two end plates are provided for the crank-case, both of which are made of steel. These are fastened to the crank-case by small screws, and are turned from the solid stock to the form shown.

A flange is formed on the base of the cylinder, which is afterwards cut off at the sides, and the base is drilled with two 2—56 screws, which hold the cylinder in place on the crank-case.

A hole is drilled with a No. 37 drill through the boss on top of the cylinder, for the air intake, and a series of holes are drilled round the cylinder about the centre of its length so that they are uncovered when the piston reaches the end of its stroke. These serve as passages for the exhaust compressed air. The connecting rods are light rectangular-section members machined out of sheet brass of about 20 gauge. As considered space is allowed inside the piston, the rods are assembled all in line on the crank-pin, and some will be off centre, coincident with the cylinder centre line.

The construction of the crankshaft, which also serves as an air-distributing valve, can be readily ascertained. A No. 6 standard taper-pin is used, this being carefully fitted to the end plate, which is reamed with a No. 6 taper reamer. The rear end-plate of the engine is machined from a piece of steel, and has a ring turned on it, which is drilled through, with a series of holes that are intended to communicate with the air-supply hole in the crankshaft. These holes are drilled to correspond to the centre line of the cylinders, and are tapped with a $\frac{10}{32}$ thread for the union nut.

The crank-pin is a piece of stock threaded at one end to fit into the crank-web. It is held firmly in place by a small nut, and is drilled at the end, with a No. 60 hole, for a hole that keeps the connecting rods from working off the shaft. The web is made from a piece of sheet steel, and has a square hole filed in it to fit a corresponding square portion that is filed at the big end of the taper-pin. When this square projection is burred over, the crank-web is firmly retained by the riveted metal. The small end of the taper-pin is threaded to receive a union by which the main air inlet is attached to the stationary crankshaft. The valve is set so that the air goes to the cylinders just before the piston reaches top centre. There is actually very little clearance between the piston top and the top of the cylinder, as the more closely fitted the pistons are to the top, the more effective travel or stoke is obtained. Care should be taken that the pistons do not hit the cylinder tops.

The front plate of the crank-case is made from steel or brass, and carries a flanged shaft by which the propeller is driven. This engine will swing a 20-in. diameter screw having a pitch of about 36 ins., with ease, and operates well on an average air pressure of about 100 lbs. per sq. in.

Obviously, the more air-pressure supplied, the higher the revolutions, and the greater the power as a consequence.

A simple collar with a small set screw is used to keep the taper valve seat tight.

After assembly the engine should be run on a lathe or drill press, by holding the cylinders and rotating the crankshaft by catching it in a chuck, supplying plenty of oil and lapping in so that all parts will be a good fit before the engine is used; this running-in process makes for easy running.

Balsa Wood

ALL the American catalogues of model accessories are listing a wood known as Balsa wood. This wood is so extremely light that it can be recommended for making aerofoils and light carved screws. It has not much strength, but it is undoubtedly useful for such purposes as making solid aerofoils, hydroplane floats, light screws and solid elevators. It is lighter than cork.

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A Goliath in Colombia

A French pilot has recently been carrying out some demonstration flights in the centre of Colombia at Medellin with a Farman "Goliath," on one occasion going to a height of 7,000 metres. He proposes to fly shortly from Medellin to Barranquilla, a distance of 400 miles over very mountainous country.

SIDE-WINDS

MAJOR COX, of Rolls-Royce, Ltd., who has been visiting the Brussels Automobile Salon, writes: "King Albert visited Rolls-Royce Stand at Brussels Automobile Salon on December 14. His Majesty expressed his great satisfaction with his Rolls-Royce car, which he has used since 1915, stating that it was still as good as when new. His Majesty also praised very highly the Rolls-Royce aero engine, fitted to his private aeroplane, and displayed considerabe interest in the model which is exhbited of the Vickers-Vimy-Rolls-Royce aeroplane which made the first direct flight across the Atlantic."

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WE are officially informed that the existing organisations for the sale of motor-spirit and other petroleum products in the United Kingdom, hitherto represented by "Shell" Marketing Co., Ltd., and the Anglo-Mexican Petroleum Co., Ltd., will, as from January 1, 1921, be combined under the title of "Shell-Mex Limited." The well-known brands of petrol—"Shell Aviation," "Shell" and "Mex"—will continue to be marketed in the United Kingdom by the new organisation.

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THE Annual Dinner of Allen-Liversidge, Ltd., 106, Victoria Street, with which are amalgamated Imperial Light Ltd., and Dissolved Acetylene Co., Ltd., took place at the Surrey Cricket Club Hotel on Saturday last, and it proved to be a very successful evening. In his speech, Mr. C. S. Gilman, J.P., Chairman of Allen-Liversidge, Ltd., who presided, said that the three firms amalgamated, formed a very powerful acetylene company, in the position to pursue and exploit their product for the general benefit of the numerous consumers, instead of continuing the competitive war which had been waged for so long. Although this assembly was the first of its kind under the auspices of the combined company, it was the thirteenth gathering of the D.A. employés, and Mr. T. G. Allen, in proposing the health of Mr. L. M. Fox (the founder of the Annual Dinner), made a most delightful and eloquent speech regarding his old adversary, but now co-worker for the ultimate success and benefit not only of the company, but the whole of the workers, of whom they were justly proud. An excellent musical programme was enjoyed by everyone.

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MR. T. A. MCCREA, who has been connected for many years with oil and spirit distribution, has been appointed assistant manager of the motor department of Messrs. C. C. Wakefield and Co., Ltd., manufacturers of Castrol lubricants.

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The Golder's Green Crash

AN inquest was held by Dr. Geo. Cohen, sitting without a jury, at Hendon Town Hall on December 16, relative to the crash of a Handley Page machine at Golder's Green on December 14. The victims were Mr. Sam Salinger, Mr. Van der Elst, Mr. Robert Bager, pilot, and Mr. J. H. Williams, mechanic.

Mr. Harold Morris, solicitor, representing Messrs. Handley Page, expressed on behalf of the directors their deep regret that the accident had taken place and their sincere sympathy with the relatives of the deceased.

Mr. Alexander Bona, one of the passengers, said he sat in the cabin of the aeroplane with three other passengers. He could see clearly through the window. The machine left the ground all right, but after rising about 100 ft. it appeared to him to be travelling at the same height and it did not rise any further. He heard the engines running the whole of the time and then the aeroplane suddenly struck a tree. He heard the crash and the next moment the aeroplane fell to the ground. The seats in the cabin were secured and the passengers remained in their places. He climbed amid the *débris* and escaped through the window. He did not think of the doorway at the time and was not certain whether the passengers could have got out that way.

Similar evidence was given by Mr. P. Curoni, another passenger.

Maj. H. G. Brackley, who had charge of the dispatch of the machine, said that Mr. Bager, the pilot of the machine, was a very experienced pilot. The machine had always functioned well, and on June 16 it had been taken into the works and completely overhauled. On November 2 the overhaul was completed and the witness tested the machine and found it as good as new. Before the commencement of the flight the machine was examined by two ground engineers and found to be in perfect order. The load carried was quite a normal one, and was arranged in the best manner for being carried safely. The witness helped to start the engine before the flight and it was quite satisfactory. The aeroplane climbed normally when it left the ground and he saw nothing wrong until his attention was called to the fact that the plane was falling.

An affidavit by Mr. Studd, another passenger, was read.

Mr. Robert Henry Macintosh said he had flown this particular machine back from Paris on December 13, and had flown the same machine on this route several times before. The landing on December 13 had been a perfect one, and nothing was wrong with the machine.

Herbert Francis Bowdage, ground engineer to the Handley Page Company, said that when the machine arrived from Paris on December 13 he examined her. Everything was working correctly, but as one of the cables had commenced to fray he put in a new rubber control. On the morning of the flight he examined the whole of the controls, and found them correct.

The Coroner recorded a verdict that the deceased died from the consequence of burns due to the crashing of the aeroplane to the ground after striking a tree. There was not sufficient evidence for him to form an opinion as to the cause of the accident.

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COMPANY MATTERS

Martinsyde, Ltd.

IN the Companies Winding-Up Court on December 7 the petition of the Brighton Motor Coach Works for the compulsory liquidation of Martinsyde, Ltd., was again before Mr. Justice P. O. Lawrence.

Mr. Owen Thompson, K.C., for the judgment creditors, said that his clients had now been paid the amount of their debt, but the costs of the petition had not been provided for. If he were given an undertaking that the costs would be paid he would agree to the petition being dismissed.

Mr. Ward Coldridge, K.C., said that the company's solicitors would undertake that the taxed costs would be paid.

On this undertaking his Lordship dismissed the petition.

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AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations:—cyl. = cylinder; I.C. = internal combustion; m. = motors

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

APPLIED FOR IN 1918

Published December 23, 1920

8,667. CLERGET, BLIN ET CIE. Valve-gear. (131,576.)

APPLIED FOR IN 1919

Published December 23, 1920

17,879. H. LEITNER. Variable-pitch airscrews. (154,264.)

18,375. WOLSELEY MOTORS, LTD., E. REEVE and E. S. LUYKS. I.C. engines with twin cylinders radially disposed. (154,268.)

18,689. A. R. MUNYARD. Balancing devices for aircraft. (154,277.)

27.747. A. P. THURSTON. Thin metal ribs, body *longerons*, etc. (154,431.)

29,199. C. GRAY and M. BOYAJIAN. Parachutes. (154,440.)

30,258. E. E. J. BONNEAU and Y. P. G. LE PRIEUR. Gyroscopic clinometers. (136,168.)

30,981. R. S. OLMSTED. Dirigible aircraft. (154,457.)

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